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TAMING THE FATHER OF WATERS

War, pestilence, and floods were for a long time considered as acts of Providence. Man, from time immemorial, was too ready to lay the results of his own ignorance, incompetence, and greed at the door of Providence. Medical science is eliminating pestilence as an uncontrollable factor in human life. We are in a fair way to outlaw war as an outworn remnant of the primitive man in settling controversies. Engineering science could make floods as unnecessary and preventable as outbreaks of yellow fever or smallpox.

We point to the frequent and destructive floods of China as a sign of her backwardness. By the same token, we must look upon the frequent floods on the Mississippi and elsewhere as a direct challenge to the engineering profession and to democracy itself. Lack of engineering skill and especially the poverty of China make her impotent to cope with the floods on the Yellow River. We are the richest country in the world, and the greatest engineering skill is at our disposal. If there is one country in the world that could control floods, it should be the United States.

Then, why is this country cursed with frequent floods which cause loss of life and damage to property that runs into millions? The unpleasant answer is that politics, local selfishness, and narrow professional pride have crept into the development of our water resources and stream control.

The improvement of a river is usually undertaken for the benefit of this or that locality. In the case of the Mississippi, at first one set of states demanded levees for protection of their land from overflow without concern as to the effect the flood drainage from their portion of the watershed may have upon the farms and towns of other states lying farther down the river. Then such southern states as Arkansas,

Mississippi, and Louisiana began in self defense to demand appropriations for building higher and wider levees within their territories, which finally gave rise to the present system of levees.

Some engineers, particularly the army engineers as represented by the Mississippi River Commission, have put their trust solely in levees and are doing so still, in spite of the repeated disastrous results. On the other hand, the advocates of spillways and reservoirs urge their method of control as the only one that can prevent floods on the Mississippi. There is no lack of forest enthusiasts who claim that forests alone will prevent floods. While each method has some merit under certain conditions, it is by itself powerless to take care of the flood waters of such an enormous river as the Mississippi.

No technical forester of any authority has ever claimed that forests would prevent floods. What foresters have claimed for a long time, and have a thoroughly proven basis for their claim, is that in any plan of stream control forests on the upper watersheds tributary to the river play an important part.

Of the advocates of the different methods of stream control on the Mississippi, only those who adhere to the policy of "levees only" and confine the current of the river to the channel between the earth dikes have so far been given opportunity to demonstrate the efficacy of their method. This policy has now been tried out at an enormous expenditure of public money for nearly 50 years, since 1879, and if the spring floods of this year prove anything, they prove that "levees only" are a failure.

We do not advocate the abandonment of the levees. This would be folly. We do not recommend that the spillway and reservoir adherents be given a chance to try their method at public expense. We do not want the foresters to be given the responsibility of curbing floods by planting or maintaining forests on the upper watersheds. The lesson that is driven home by the repeated flood disasters in this country is that our approach to the whole flood problem is unscientific, haphazard, not guided by the experience of older countries, and leaves out of consideration many important factors in control of floods. We stand out for a universally recognized principle: *that each stream should be considered as one unit from source to mouth.*

Before any further flood control on the Mississippi is undertaken, the first need is a competent investigation of all factors affecting it. This investigation should include, first of all, a thorough study of the Mississippi and its tributaries with possible dam sites, the forests which

now exist and those which need to be replaced, the amount of erosion and the means to check it, the protection of the surface of cultivated, pasture, and waste lands against cutting away by heavy rains, the whole question of levees and channel control, and the adaptability of storage dams not merely for holding back flood waters but also for generating electricity.

It is further essential that this investigation should be made by men with open minds, who are not already committed to levees as the only method. There are many great engineers outside the army whose opinions on this question are well worth having.

Senator Newlands, toward the end of his career in 1917, clearly recognized the value of such approach toward the solution of the flood problem. The Newlands-O'Connor Bill (H. R. 5025) provided for a commission, including the Secretaries of War, Agriculture, and the Interior and competent engineers to make such an investigation as a basis for further legislation on stream control. This bill should now be revived, either in its original form or modified as the conditions may require, and passed at the next Congress.

If this is not done, the "levees only" politician will be again in Congress next year and ask for more Federal money with which to build still higher and wider levees, courting further disaster to people and property in the southern Mississippi Valley.

GEORGE BISHOP SUDWORTH

1861-1927

With the passing of George Bishop Sudworth the Society of American Foresters mourns one of its founders as well as one of the most honored and distinguished scientists on its rolls. He was a pioneer in the profession of forestry in the United States, a guide and promoter of its early development. He lived to see it working vigorously on a nation-wide scale to make his country a better place in which to live. Dean of the members of the United States Forest Service and of the forestry profession of the country, he witnessed the growth of forestry over a period of nearly 41 years.

Early interested in trees and tree growth, as a botanist in the Department of Agriculture he directed his attention to forests and forest development, and when forestry in America was advocated he became one of its ardent supporters. As the profession developed, his knowledge of trees and of woods made him an authority and in later years brought him recognition and honor. Sympathetic and lovable by nature, he was both guide and counsellor to many of the younger men in the early days of the profession. In later years he turned to Boy Scout work as an outlet for the irresistible call he felt to share with others the inspiration he received from his study and association with the trees and forests of America. The love of trees and forests that he kindled in the youth who came in contact with him, and the faith in the profession of forestry that he showed through all the years, are left us for our heritage.

Although George Sudworth is no longer with us in the flesh, his spirit remains and will live with us forever.

H. A. Smith,
E. H. Clapp,
E. E. Carter,
E. N. Munns,
Committee.

George Bishop Sudworth
1861-1927

GEORGE B. SUDWORTH, DEAN OF FORESTRY PROFESSION

George Bishop Sudworth, Chief Dendrologist of the United States Forest Service, dean of the forestry profession in the United States, and distinguished authority on American trees, died at his home in Chevy Chase, D. C., May 10, after a very brief illness.

Mr. Sudworth had served continuously with the Forest Service and the old Division of Forestry and Bureau of Forestry which preceded it, for nearly 41 years, having received his appointment in 1886. He was by far the oldest member of the Forest Service in point of service. For the last 15 years he had also served as a member of the Federal Horticultural Board, participating in its important decisions regulating the shipment of plants and nursery stock for the purpose of checking the spread of plant diseases and insect pests.

Mr. Sudworth was the author of a large number of publications on dendrology and other phases of forestry, and was a leading authority on the subject in this country. One of the most important of his contributions to systematic dendrology was the "Check List of the Forest Trees of the United States," first published in 1898, and reissued in a completely revised edition only a few weeks before his death. The book has become a classic authority on the nomenclature and range of American trees. Along with the Check List in importance are to be ranked "Forest Trees of the Pacific Slope," "Cypress and Juniper Trees of the Rocky Mountain Region," "Spruce and Balsam Fir Trees of the Rocky Mountain Region" and "Pine Trees of the Rocky Mountain Region."

Sudworth's work in dendrology was based on wide exploration, and on his intimate knowledge of the chief forest regions of the United States, many of which he traversed on foot. He explored a number of the early western Forest Reserves, as the National Forests were first called, publishing reports as a basis for their administration and silvicultural development. He discovered and named a large number of new species and varieties of trees, and many type specimens are contained in the very extensive herbarium he collected.

Born in Kingston, Wisconsin, in 1864, Mr. Sudworth attended the country schools, and obtained an A. B. degree from the University of Michigan in 1885. After a year of service as an instructor in the Michigan Agricultural College, he was appointed a botanist in the Federal Government service. He was made chief of the dendrology

division of the Forest Service in 1904. In 1897 he married Frances Gertrude Kingsburg, who survives him.

He was a member of the Washington Academy of Sciences, the Biological and Botanical Societies of Washington, the Society of American Foresters, and an honorary member of the Finska Forstsamfundet.

CHARLES SPRAGUE SARGENT

On March 22, 1927, in Boston, at the age of 84, died Charles Sprague Sargent—Arnold Professor of Arboriculture at Harvard and Director of the Arnold Arboretum. His death passed almost unnoted by the daily press and the public. It must not go unnoted by foresters and for several reasons. Professor Sargent was the founder of American dendrology. He played an important part in the movement for the conservation of forest resources. The Society of American Foresters in recognition of his services to forestry elected him, almost at its beginning, an honorary member.

To few people is given the rare opportunity of building their own monument during their lifetime. Charles Sprague Sargent did it. His monument is the Arnold Arboretum. Half a century ago the city of Boston leased for 1,000 years to Harvard University a worn-out New England farm upon the pledge given to the trustees of the estate of Benjamin Arnold of New Bedford "to develop it into a scientific garden in which to grow, insofar as possible, every tree or shrub capable of enduring the climate of Massachusetts." Six thousand species grow there today. They were brought from Sakhalin and Formosa, Tibet and West China, the Himalayas and the snow-clad peaks of equatorial Africa, Europe, and the two Americas, the Caucasus and the Barbary Coast. Yet, before his death, Professor Sargent looked longingly toward the forests which covered "the ranges of the Altai Mountains, the southern boundary of central Siberia, and the great interior region south of those mountains" as a still unexplored, potential source of new species.

For 55 years, beginning when the Arboretum was a mere idea, he served as its Director. He never retired; until two weeks before his death he continued his daily visits to the Arboretum. His work began in 1878, when a former president of the Massachusetts College of Agriculture sent Sargent the first seeds to reach America of the now familiar tree lilac and climbing hydrangea. Four years later a Russian doctor who had heard of Sargent's plans, sent him seeds of trees from northern China. In 1892 he himself went to Japan. Of the 6,000 species which grow in the Arboretum, 1,000 species grow there today which had never before seen America. No wonder the American Genetic Association calls Sargent "the outstanding leader in the world of plant introduction."

Sargent's knowledge of forest trees and shrubs laid the foundation of dendrology, without which there would be no science of forestry. The 14 magnificent volumes of his "Silva of North America" is an encyclopedia of the trees of the continent, and is the bible of every forester.

In connection with the 1880 census, he made for the government a census of its forest wealth, one by-product of which is the unique Jessup collection of North American woods in the American Museum of Natural History in New York city. He was one of the leaders in persuading President Cleveland to set aside the first forest reserves. He was the leading spirit in saving the redwood forests of the coast, in establishing Glacier National Park, and it is to him that forestry work in the state of New York owes its beginning.

Books perish. Fame fades with time, but trees endure and from their seeds new trees grow. Sargent's name will not be forgotten as long as the trees which he gathered from every corner of the world continue to grow in the Arnold Arboretum and provide a continued source of knowledge to the scientist and enjoyment to the common people.

CAN THE NATIONAL FORESTS PAY?[1]

(With Particular Reference to Montana and Northern Idaho)

By Elers Koch

A good many years ago Mr. Pinchot, then chief of the Forest Service, made what seems now a rather rash prediction that the National Forests would be self-supporting in a very few years. While we have since recognized that this prediction was premature probably most of us have considered without much analysis of the subject, that with increasing stumpage prices and growing scarcity of timber, the self-supporting stage was clearly on its way.

I have set down some figures on costs and production for District 1 which may mean something. I have not been rash enough to attempt to analyze figures for any other district. I think probably several of them would make a more promising showing than this district.

The 1926 fire season was a discouraging blow to all of us in District 1. We saw hundreds of thousands of acres of our best timber and most promising young growth wiped out. The productive capacity of several of the North Idaho forests was materially reduced for the next hundred years. Money was spent like water trying to hold down the losses. The only proposal for bettering the situation in the future seems to be still more money for protection.

Consideration of this condition inevitably leads one to question where we are going. The Forest Service has been given the job of protecting and administering the National Forests, but that does not relieve us from the responsibility of some sort of a check-up on the finances of the job. If the forests have a possibility of making money for the Federal Government sometime in the future, we ought to know it as a possible compensation for the present period of operating at a considerable loss. If the annual statement is always going to show a red-ink balance, the Forest Service and the people of the United States ought to have at least an approximate estimate of how much the deficit will be in order to determine whether it is worth while.

Practically everybody recognizes that there is a considerable difference between the object of management of public and private forests. Forests in private ownership must as a general rule pay adequate returns on the investment. Otherwise the business of growing timber

[1] Paper read at meeting of Northern Rocky Mountain Section on March 7, 1927.

will not attract private capital. Owners of capital will prefer to invest in other forms of business which give better returns. There are a few exceptions to this. Dr. Schenck has pointed out in some of his lectures the social prestige and political advantage which has gone with the ownership of large forested estates in some of the European countries. These indirect returns have been sufficient to justify families holding forest property for centuries with a return of only two or three per cent on their capital value.

In the consideration of public forests, indirect values must be given proper weight. The value for water-shed protection is self-evident. Recreational values are so great that the country has thought it worth while to maintain at great expense very large forested areas in the National Parks solely for recreation. The indirect returns to the people of the United States in the maintenance of a continuing supply of wood and forage has always been considered one of the principal values of the National Forests. I would not for a moment deny that value, but before swallowing the idea whole, one should perhaps consider whether the purpose can not be met more advantageously by some other means. A constant and reliable wheat supply is very essential to the nation, yet nobody proposes that the Government operate large wheat farms at a loss on the poorer lands in the public domain in order to insure a supply of wheat.

I do not believe the wheat farm suggestion is exactly analogous to public forests, but the idea is brought out to indicate that the indirect benefit of public timber production can not be accepted as a matter of course, but must be subjected to some analysis and questioning.

If it could be shown that in the reasonably near future, the National Forests could be expected to bring in returns greater than the cost of operation, or even balance expenditures with receipts, almost everyone would concede that with the addition of the indirect benefits the maintenance of the forests on something like the present basis will be desirable. If, on the other hand, the best possible prediction of future costs and yield showed that the forests are a hopelessly losing proposition financially, and will be a perpetual drain on the Treasury of the United States, should not the managers of these forests try to determine how great that loss will be, balance it against the indirect values, and perhaps consider some radical revision of present ideas of administration?

In order to throw some light on the subject I have set down the cost figures of some of the forests in this district against the best data

we have on present and possible future returns. The Forest Service records show total costs for each forest and also operating costs, the latter figures eliminating all costs which are in the nature of permanent improvements of the property, as roads, trails, buildings, and planting. In setting down total costs I have thrown out expenditures from the co-operative fund, since the co-operative deposits are not shown under receipts and consequently should not show as expenses. I have also eliminated road construction done by the Bureau of Public Roads, since in a general way the class of roads built by this bureau are public roads constructed for general purposes and not primarily for benefit of the forests.

I will take up the Coeur d'Alene Forest first, since it is usually considered the prize package of this district.

Averaging the figures for the fiscal years 1924, '25 and '26, we find that the mean annual operating cost has been $88,696, total annual cost $134,748, and annual receipts $190,357. During this period, then, the Forest has paid all costs, including permanent improvements, and has had a handsome annual profit of $56,000.

The management-plan figures indicate a sustained annual yield of 50,000 M feet. Assuming an average stumpage value of $5 per M, which is less than current prices, the Coeur d'Alene Forest seems good for an average annual return of $250,000. This will allow for a considerable increase in expenses, particularly for road construction, which is badly needed, and still make the forest a good revenue-producer.

The annual production of 50,000 M feet is based on present distribution of age classes and present volumes of merchantable timber. This limitation should last for the next 60 to 70 years. Thereafter, due to the present excess acreage of younger-age classes, a considerable increase in the annual cut should be possible. The productive area of the forest contains 343,000 acres of white pine type and 211,000 acres of other types. If we assume a very conservative yield of 25 M per acre in the white pine type and 8 M per acre in other types on a 120-year rotation, we get an average annual production per acre of 208 board feet in the white pine type and 67 feet per acre in other types. Using these figures on the above acreages and assuming an approximately normal distribution of age classes, the forest will produce 85,000,000 feet per year. At $5 per M this would amount to $425,000. It seems clear that if reasonably successful protection from fire can be attained a forest like the Coeur d'Alene will always be a good producer of net revenue to the Government. It will justify intensive develop-

ment, permanent road systems, and planting of all denuded areas in order to keep up full capacity. The figures are conservative. Planted stands in the white pine type instead of producing 25 M feet per acre in 120 years should go 50 M feet per acre in 100 years.

Turning now to the Kaniksu Forest, we have one of the best tracts of forest soil in the District, but in desperately bad condition, between the two extremes of fire and decadence. A large part of what forest has not burned in the last 50 years is overmature and defective, carrying not more than 20 to 25 per cent of the possible yield per acre which should be produced on a 100 to 120-year rotation.

The three fiscal years 1924 to 1926 include two fairly favorable fire years and the bad season of 1925 but not the still worse fire season of 1926. In these three years the average annual operating cost was $115,836, the average total cost $199,865, and the average annual receipts $149,285.

The 1925 and 1926 fires have pretty completely upset the management-plan made in 1924, but I have made a rough deduction for the fire losses and figure the present limitation of cut will be established at about 25,000 M feet. The forest could sustain about that cut for the next 60 years with a considerable increase thereafter, but it is doubtful, considering the character and species of the remaining stands, whether this cut can be maintained unless market conditions radically improve. Within three to five years the cut of the Kaniksu Forest will probably fall off to seven or eight million a year and will not pick up again until lumber values very considerably increase. On the basis of an average cut of 25,000 M feet at $4 per M the unit will produce $100,000 a year. This will not pay the operating cost and only about half the total expense.

The Kaniksu is one of the forests where we will have to look a long way in the future for returns. Without going into details of the calculations, I figure that beginning about 60 years from now the forest will produce around 62,000,000 feet annually. Assuming a $5 stumpage rate, that is $310,000 a year.

The St. Joe Forest is so badly burned that it will be 70 or 80 years before it can come up to anything like its full productive capacity. The average operating cost for fiscal years 1924, 1925 and 1926, was $61,-675, total annual expense $122,699, and average annual receipts $4,883.

On the basis of partly completed management-plan the present limitation of cut will be set up at about 24,000 M. A stumpage value of $4 per M would make the annual money return amount to $96,000,

which will pay the operating cost but not the total cost. Unless stumpage rates go up considerably it would seem likely that the St. Joe Forest would be run at a loss until the 1910 burned area is ready to cut.

The forest contains in the main division 130,000 acres of white pine type and 142,000 other types. The Palouse division, which is unclassified, contains 39,000 acres. Assuming that the white pine type will yield at 120 years 25 M per acre, the mixed types 8 M and the Palouse division 20 M per acre, the possible annual production of the forest would be 45,000 M feet. At $5 per M this would amount to $180,000, which would make the forest show a net profit. Undoubtedly the yield will be considerably increased by planting denuded burned areas. The expenses given for the last three years include an average of $10,000 a year for planting.

Figures for the Lolo Forest are given as an example of one of the Western Montana forests. The last three-year average operating cost was $55,146, total cost $83,880, and receipts $23,471. The present limitation of cut is 30,000 M feet. Since much of the timber on the forest is in low-grade species or inaccessible, it is not likely that the average cut can be raised to 30,000,000 feet for at least 20 to 30 years. When that time is reached the stumpage should bring about $3 per M or a total of $90,000, which would make the forest self-supporting. The full productive capacity of the forest will not be reached for 70 to 80 years when the large area of 35-year young growth begins to be merchantable. After that time the cut on 719,000 acres of productive land should be about 72,000 M a year. At present stumpage values of $3 per M this would amount to $216,000 a year.

The preceding specific examples have been given to give a definite idea of the possibilities of individual forests, particularly those where the fire problem is a very live question. In the District as a whole the information available for predicting future timber yield is less accurate than for some of the individual forests, but approximate figures will give an indication of the outlook.

In the fiscal years 1924 to 1926 the average operating cost for the District was $1,348,870. The total annual expense, not including cooperative funds or expenditures by the Bureau of Public Roads, was $2,421,131. It will be noted that nearly half the expenditure, the difference between these two figures, went into improvement of the property.

In considering the relation of expenditures to returns in the future, some consideration should be given to the probability of any con-

TABLE I

Costs and Estimated Returns Present and Future—Montana and Northern Idaho

	Coeur d'Alene	Kaniksu	St. Joe	Lolo	District 1
1924 to 1926 average operating cost	$ 88,696	$115,836	$ 61,675	$ 55,146	$1,348,870
1924 to 1926 average total expense	134,748	199,865	122,699	83,880	2,421,131
1924 to 1926 average receipts	190,357	149,285	4,883	23,471	694,762
Sustained yield under present conditions, M feet	50,000	25,000	24,000	30,000	645,000
Assumed value per M	5	4	4	3	3
Value of above	250,000	100,000	96,000	90,000	1,935,000
Future sustained yield (60 to 80 years hence) M feet	85,000	62,000	45,000	72,000	1,500,000
Assumed value per M	5	5	4	3	3
Value of above	425,000	310,000	180,000	216,000	4,500,000
Present annual grazing receipts					162,000
Estimated future grazing receipts					300,000

siderable increase in present costs in order to afford adequate fire protection and to meet the needs of growing business. The expenses for permanent improvements of the forests are of course subject to variation from year to year with congressional appropriations. We hope the appropriation will not decrease, but there is no special reason to expect any considerable average increase. If we can continue indefinitely with present allotments it is likely that the necessary development and improvement of the forests will keep up with the current needs. The only way in which the forests will ever be brought up to their full sustained yield will be through a gradually progressing system of roads.

While increased appropriations are desired and are absolutely essential to adequate fire protection most of us feel that such increases would be balanced by corresponding or greater decrease in fire-fighting cost, and consequently there would be no net increase in total costs. If it should be demonstrated that fire losses can not be held to a reasonable figure with present expenditures, there would arise the question—how far should such expenditures be increased? In the case of a private owner it would seem obvious that if trial and experience indicated that expenditures or losses were so great as to make the property unprofitable, the only thing left would be to take off the values as soon as possible and abandon the property. Since it seems clear that the Federal Government will continue to operate the National Forests, whether profitable or not, and abandonment seems unthinkable, then it seems to come down to a question of choosing between direct expenditures of money and an annual loss greater than that expenditure. Theoretically, fire protection costs should be increased to the point where any further increase will not be rewarded by a greater decrease in losses. That is the ultimate point at which to stop, providing fire protection is not abandoned entirely through considerations of profit and loss.

If it is agreed that adequate fire protection can be obtained with present costs by expending the money at the right time and place, the only considerable increase which seems to be essential in the future is a sufficient amount to take care of growing timber-sales business. A large increase in timber business could be handled for about 52 cents per thousand. When the cut is raised from the present 135,000,000 a year to the full limitation of 645,000,000, this will involve an increase of around $250,000 to handle it. Aside from this necessary increase there seems no reason why present costs should be con-

siderably higher for many years. This would bring the total cost of running the District up to about $2,700,000.

Theoretically, from an accounting standpoint, improvements should be segregated and considered as a permanent investment which enhances the value of the property, and not as a current cost. However, if the annual improvement cost remains constant or increases in the future, it seems simpler for our present purpose to treat it as an annual cost. After all, improvements have to be paid for some time, and the annual returns of a going forest property should pay for them.

Let us next see how the income will balance against this expense. The average annual income for the last three years is $894,762.

The principal sources of revenue are grazing and sale of timber. Grazing receipts have been running around $160,000 a year. With the new grazing fees fully in effect and with a gradual increase in stocking of all forests to the full capacity of the ranges it is estimated that grazing receipts will increase to about $300,000 a year.

The present limitation of annual cut of 645,000 M for the district represents about what can be allowed as an average for the next 60 to 80 years considering the existing distribution of age classes and present volumes of merchantable timber. The figure will be modified more or less as management-plans are completed, but is probably not very far off. No one can say what stumpage prices will be in the future, but it is possible to say with a reasonable degree of certainty about how much timber can be cut on the forests within the next 60 to 70 years. Most of the forests have a reserve of present merchantable timber and a big reserve of young timber for the most part under 40 years old. It is generally a rather simple calculation to distribute the present mature timber over a period required for the young stands to reach merchantability. Even with our very limited knowledge of growth, there is not much chance for a very wide error in determining this present limitation of cut.

The increase from the present cut of about 135,000,000 to the limitation of 645,000,000 will probably take at least 25 to 30 years, possibly longer. There will be little or no increase until present market conditions radically improve, so that other species than white pine and yellow pine can be handled. While a general gradual increase in stumpage prices may be expected, it must be remembered that we are progressively cutting the best of our present stands. Consequently the average value of about $3 which National Forest timber in this district has brought for the last 10 years can not be expected to increase

very considerably for a long time. Applying the three-dollar rate to the 645,000,000 possible annual cut will produce a return of $1,935,000. Add $300,000 grazing receipts and we have $2,235,000, not enough to cover the predicted expense of $2,700,000. It will take $4 stumpage and cutting to full capacity of our forests as they now exist to make the district break even. I am not prepared to make any predictions as to future stumpage rates. The average rates for National Forest timber cut in District 1 for the last 10 years has been as follows:

1917	$2.41	1922	$3.21
1918	2.45	1923	3.24
1919	2.38	1924	3.20
1920	2.49	1925	4.71
1921	2.10	1926	4.43

The average for the 10 years is $3.06. The rates for the past two years are abnormal as we happen to be cutting rather heavily in some high-priced white pine sold on a peak of the market. Furthermore, the district is cutting the valuable white pine in much greater proportion than it exists in the district. White pine forms about 10 per cent of the total volume of timber in the district, yet in 1924 it made up 24 per cent of the district cut, 37 per cent in 1925, and 41 per cent in 1926. As the high-value species and more favorable chances on the forests are cut out it will progressively be necessary to cut a higher percentage of present low-value species on increasingly inaccessible areas. We of course expect a considerable increase in general stumpage values, but it is very doubtful whether such increase will keep up with the depreciation in average accessibility and quality of the stands remaining to be cut. It can hardly be expected, therefore, that there will be much rise in the average stumpage rates of the timber cut in the district for many years, keeping in mind that 80 per cent of the timber is in species other than white and yellow pine, and most of it having a minus value at the present time. I should estimate roughly that at least 75 per cent, possibly 80 per cent, of the timber in the district now has a minus value if appraised on an operating basis. The ultimate productive capacity of our fire-damaged and decadent forests is of course much greater than the present capacity. Beginning 60 to 80 years from now, when the present partly stocked and damaged stands have been cut and the vast areas of young growth begin to reach maturity, it should be possible to increase the cut to about the full annual capacity of the forest, that is, there will be a normal or better

than normal distribution of age classes, so that at least the full growth of the forest under natural conditions can be cut each year.

A good many forests which have been very badly burned, such as the Cabinet, St. Joe, Clearwater, and Selway will have a big surplus of the age class resulting from the 1910 burn all coming merchantable at about the same time and when that happens it may be possible for a considerable period to cut considerably more than the normal growth in order to reduce this surplus.

Of the 22,605,000 acres net forest area in the district, approximately 15,379,000 are classed as productive land. This will be increased somewhat by planting devastated land, but the increase will not be enough to change the figures noticeably. This acreage includes all commercial forest types, white pine, yellow pine, Douglas fir, larch-fir, spruce and lodgepole. An average annual productive capacity of 100 board feet per year is undoubtedly a conservative estimate. On this basis the 15,000,000 acres should produce 1,500,000 M a year. Even at present stumpage rates of $3 per M this would amount to $4,500,000 a year, to which grazing receipts would be added.

To summarize, then, it has been demonstrated that the National Forests in this district are now returning only about one-half their operating cost and one-fourth their total annual cost; that during the next 60 or 70 years, even if the cut of timber is increased to the full sustained yield of each forest, the returns will be half a million dollars less than the expenses, assuming an average stumpage rate of $3 per M. It will take $4 stumpage to make the forests break even. Future yields commencing 60 to 70 years from now will be sufficient, even at present stumpage rates to produce a net profit of over $2,000,000 annually, which may be increased considerably by planting and acquisition of private lands.

The preceding figures are all predicated on reasonably successful fire protection. The yield figures used are conservative enough to allow for a loss of one-tenth of one per cent per annum, which has been tentatively set up as a mark to shoot at. The present average rate of loss in northern Idaho would make successful forestry practically out of the question. I firmly believe that successful protection can be attained, and with little or no increase above present costs. It is largely a matter of spending the money at the right time in the right place.

The profit or loss on the National Forests in this district bears little relation to the general possibilities of successful forest practice in the region. I have not considered taxes or interest on the invest-

ment, both of which would have to be taken into account by the private owners. The National Forests do not have to pay taxes, or if they do pay what is called a tax, it becomes merely part of the income from public property to the public. The interest on the investment is a theoretical rather than actual charge both because no initial investment was involved in acquiring the lands, and because by and large they have little capital value which could be immediately realized.

The Forest Service in handling the forests in this district has got to face a long period of building up a low-value and much damaged property to a producing condition. It has got to depend on the indirect values resulting from its management to compensate for the loss during the long building-up period. This loss is now over a million and a half dollars annually and will probably average half a million for the next 60 years. Whether this deficit is considered as an investment for the rather distant future, or whether it is considered that the current benefits from the National Forests in the region are sufficient to meet the deficit does not make a great deal of difference. I can not conceive of any radical change in the present policy of the Federal Government in administering and protecting the public forests. We have the bear by the tail and can't let go. Halfway measures will be worse than nothing. The only chance for making the situation any better in the future than it is today is to build up the production through successful fire protection and complete restocking of areas cut over. More intensive management has a better chance of financial success than less intensive. Fire protection costs will remain about the same regardless of the productivity of the forest. A planted area really has only to carry its initial cost with interest and not the annual protection and administrative costs which will go on just the same whether the area is planted or not.

Ten dollars an acre spent now for planting or clearing up a worthless growth of defective hemlock will amount to $192 in 100 years at three per cent compound interest. The timber crop will be about three to five times that amount. If the $10 is not spent there is no production, but the cost of protecting that acre goes on just the same. It comes down to either dropping the whole thing, which I am sure the public would not stand for, or looking on the National Forest as a long-time investment in which we must keep on putting in more money in order to build the property up to a profitable basis, and make the most out of each acre.

It must be realized that a considerable part of the present expendi-

ture is for development and administration of the indirect benefits, without hope or expectation of any direct returns. If it were not intended to exploit these indirect returns the cost could be cut radically. For example, take the Beartooth Forest. The average annual expense on this Forest for three fiscal years has been $50,000. The average receipts from grazing for the last three years has been $3,809, and from timber $3,505. The limitation of annual cut is 5,000 M feet, and from present indications it will be a very long time before this amount is approached. The greater part of the forest is barren rock and glacier, with only a fringe of productive timber and grazing land. So far as the administration of necessary grazing, fire protection and timber business goes, it could probably be handled for one-third the present expense. The difference is what is being put into the indirect benefits of the forest—recreation, water power, etc.

The same thing is true to a less degree for most other forests. It is difficult to segregate expenses incurred primarily for indirect benefits, but if it were desirable to omit all non-revenue-producing activity and cut down to a straight business basis of producing timber and forage at the lowest cost, and disposing of it at the greatest profit, I have no doubt the management of the forests could be so reorganized as to show the possibilities of a net profit. Without proposing at all that such action be taken—but merely to give some idea of the relation of the present expenses to the revenue-producing activity and the non-revenue-producing activity—we might speculate what could be done if we were sternly ordered to make the National Forests pay as soon as possible. Under such circumstances we would cut out all game protection and all recreation activities except a few rental opportunities which might bring in a net revenue. We would cut down grazing administration to the minimum point which would bring the greatest net returns and not damage the ranges. We would increase grazing fees to their full commercial value. We would refuse all small timber sale business which did not pay. The forests would be classified, and so far as possible all the poorer and nonproductive areas would be dropped from administration or fire protection. If necessary to secure adequate fire protection the public would be entirely excluded from the forests through the fire season.

The net result of such action would probably reduce present costs by 25 to 30 per cent. My guess is that the public would very quickly demand that we go back to the present basis, whether the forests paid expenses or not.

Before closing, there is one more point of view I might introduce, that is, the sentiment so often expressed by timber-owning lumbermen who resent the competition of Government stumpage, that the National Forests were created primarily as a reserve of timber for a time of future shortage, and that Government stumpage should not be thrown on the market at the present time so long as there is still an adequate supply of timber in private ownership.

The acceptance of such a policy would, of course, mean postponement of returns, and a long period of expense for caring for the National Forests with little or no income. In spite of this disadvantage there are many convincing arguments for at least an approach toward the timber reserve policy. All economists and foresters deplore the evils of the present situation in respect to private stumpage. We all know that timber is being forced on the market faster than it should be to escape the accumulation of taxes and other carrying charges. The result is unsatisfactory prices for forest products, poor utilization, and lack of encouragement for any sort of permanent forestry methods by the timber owner. It seems to me self-evident that if the United States Government joins this scramble to liquidate stumpage, the situation becomes so much the worse. The Federal Government, with its freedom from taxation, and its strong financing, is in much better position to hold back its stumpage than any corporate owner.

A hundred per cent application of the timber reserve idea is, of course, impracticable. Some timber must be sold. The essential thing is that the sale of timber should not be crowded by encouraging new mills or the opening up of new timber tracts. As a general rule, sales should be made only for local consumption, or to take out timber which has been developed by private logging operations and the removal of which should logically be handled over the improvements which have been installed. In other words, the Forest Service should play a waiting game, taking only the business which comes to us and not going out after it. There will undoubtedly be a few exceptions to this rule, but they should not invalidate the general idea of holding back Government stumpage during the period of crowding onto the market the big virgin timber holdings in private ownership.

The result of such policy would, of course, mean a long period of continued expenses and small returns. I doubt if that matters much. The main concern of the people of the United States is for adequate protection of the National Forests and production of timber when it is needed. If our fire protection is successful, and our silviculture

sound, and we are able to show to the people green forests growing good timber crops and constantly increasing in value and productiveness, they are going to be willing to pay taxes to keep up the administration and let the harvesting of profits go to the future generations.

GRAZING AND REFORESTATION

By G. A. Pearson
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Grazing in its relation to forest regrowth presents a problem which is just beginning to be appreciated by American foresters and is almost unheard of by the public. Until recently it has been regarded as a local matter peculiar to the Southwest; but as more information comes from other regions, it grows more and more evident that we have to deal with a condition of widespread occurrence. Although nearly all forest lands are concerned, this discussion will deal primarily with the timbered areas of the national forests, because the time is ripe for meeting the situation on the national forests, and because grazing interests are now striving to obtain concessions from Congress which, if granted, would seriously hamper forest management.

That browsing by livestock is capable of destroying or seriously injuring young forest growth is no longer questioned by foresters. Yet there is wide difference of opinion within the profession as to the gravity of the situation and as to what remedies are needed and economically justified. The dictum of European forestry that grazing and timber culture are incompatible has been directly challenged. In the administration of the national forests there has grown up a new school which teaches that, contrary to European experience, grazing and forestry may go hand in hand without endangering the latter. It is natural that this idea should appeal to forest administrators in the West, where most of the permittees are graziers, especially in the pioneer days of forestry when it was believed that the very existence of the Forest Service depended upon maintaining the good will of forest users.

The wide divergence between the two schools, one of which sees antagonism and the other harmony between grazing and forestry, may be accounted for partly by the interests and associations of individuals, and partly by actual differences in the conditions encountered.

The attitude of the individual forest officer is likely to depend much upon whether his experience has brought him more closely in contact with timber growing or with stock growing. What a man observes for himself, his reaction toward what he sees and hears, and the natural trend of his reasoning are influenced by his immediate interests and general background of personal experience. When it is

considered that of the entire Forest Service personnel those whose major duties are in grazing or general administration are more numerous than those directly concerned with timber growing, it is easy to understand why there should develop a point of view at variance with that of the dyed-in-the-wool silviculturist.

Grazing damage is influenced by many local conditions such as the character of the range, number of stock, and conditions affecting the growth of trees. It is now generally conceded that when there is an abundance of good forage for all stock on the range, young trees are less likely to be browsed than when the feed is short. Another important factor is the density and growth of tree seedlings. With a stand of 50,000 seedlings per acre the chances that 2,000 may survive are better than if we start with only 5,000. If appreciable numbers spring up every two or three years, the chances are better than if the interval is twice as long. If seedlings make an average annual height growth of six inches during the first ten years, a greater number are likely to get beyond the reach of stock than if the growth is only two inches a year.

THE STRUGGLE BETWEEN THE FOREST AND GRAZING

With such a variety of conditions as are encountered in the United States, generalizations must be used with caution; yet in the maze of apparently conflicting observations one fact stands out as a basic principle. Full crops of timber and forage can not grow on the same ground at the same time. The two may thrive side by side for a few years, but sooner or later one or the other must decline. Wherever there are forests and grazing animals there is conflict. The fact that this conflict assumes different aspects in different regions does not alter the essential facts. Where conditions of climate and soil are favorable for tree growth, it is usually the forest that prevails. Very little forage can grow under a stand of trees which approaches full stocking. This is the reason why little is heard about grazing damage in the most heavily timbered sections of the country. It is only with the aid of fire or lumbering that grazing can gain a foothold in these forests, and without these allies it can seldom maintain itself long. But go to regions of less vigorous forest growth, and the tables are turned. Even under these conditions the forest undisturbed by fire and logging may hold its own, but with the aid of these agencies grazing gains the upper hand and holds it.

GRAZING DAMAGE IS USUALLY UNDERESTIMATED

The areas subject to damage by grazing are more extensive and widespread than is generally supposed. In the writer's opinion much damage is taking place which is not recognized or is not given due weight. The reason for this is that foresters generally, to say nothing of the public, are not trained to detect damage to very young seedlings, and they have a faulty conception of what constitutes satisfactory reproduction. Coniferous seedlings bitten off during the first two years of their life usually disappear entirely and, unless detailed examinations have been made, there will be no record of their having existed. What is often taken for good stocking of young timber is in reality understocking. Mature stands are often used as a standard of density for reproduction, disregarding the well known fact that young trees must be closely spaced in order to produce the straight, clean stems needed for saw timber.

The real test of reproduction comes after logging. Fortunately, many of our mature stands have "advance" reproduction or young growth in the open spaces between the old trees. When this condition prevails the problem is much simpler than when there is little or no advance reproduction. Even under the former conditions, however, there will be considerable bare spaces after the old trees are removed, because seedlings seldom grow directly under a dense canopy, and besides the young growth will be broken down by logging on large portions of the area. Except under unusual conditions, as where large quantities of seed are stored in the leaf litter, or where a large number of seed trees are left, reproduction after cutting is slow. In the Southwest, yellow pine, Douglas fir, and Engelmann spruce require from 15 to 20 years on the average to restock after cutting. In more favorable regions the period is shorter, but even there grazing needs to be closely guarded.

Although the need for reproduction is most apparent directly after logging, it may be almost as great in virgin stands. Because of the slowness with which western yellow pine restocks, advance reproduction of this species is now advocated throughout most of its range. Advance reproduction not only facilitates restocking after cutting, but it is needed in order to utilize idle land and build up the younger age-classes in mature stands some of which will not be cut for fifty years or more. Our virgin forests throughout the country are generally far understocked. In Arizona where average stands of yellow pine on good sites yield only from 8,000 to 15,000 board feet per acre, fully stocked

plots carry from 40,000 to 50,000 board feet per acre. Show has found a similar relation in California, with the difference that there the volumes run much higher than in Arizona. The light stocking of mature stands is generally due to the failure of young growth to replace the old trees which are continually dropping out from various causes. Normally, the space given up when a tree dies is promptly occupied by the expansion of its neighbors, or by young trees. But if fires run over the ground every few years there may be no young trees to fill the gaps. Where fires have occurred periodically for a hundred years or more, we usually find open spaces from 50 to 200 feet in diameter between groups of trees. In many forests these openings occupy more than half of the total area. In California and in parts of Arizona and New Mexico they have restocked following the exclusion of fire during the last twenty years; but on extensive areas in the latter two states reproduction is still lacking. Recent investigations have shown that in most cases these failures are due to grazing damage.

INVESTIGATION OF THE GRAZING SITUATION

Because of the fact that the grazing problem has been more exhaustively investigated in the Southwest than elsewhere in this country, it is believed worthwhile to present some of the findings in that region. While it is realized that conditions may be vastly different in other regions, yet there are certain relationships which are likely to be the same wherever stock graze in the forest. What has happened in the Southwest can happen elsewhere unless the situation is kept well in hand. Whether or not grazing is a problem in any locality need not be a matter of conjecture, for it can readily be determined by investigation.

Annual seedling counts on the Coconino and Tusayan National Forests, supplemented by general observations on other forests in Arizona and New Mexico, give a fairly complete history of yellow pine reproduction in this region since 1907. In the following accounts cattle range refers to areas grazed by cattle and a few horses, but no sheep; sheep range refers to areas grazed by sheep and also by cattle and horses. There are practically no ranges in this region which are grazed by sheep exclusively.

Examinations on the Coconino and Tusayan in 1908 showed fine stands of seedlings and saplings on considerable areas. These were mostly either ten or twenty-six years old, the result of unusually high germination about 1898 and 1882. Remnants of these age-classes,

usually damaged, were found on most of the unstocked and poorly stocked areas, indicating that they were once of widespread occurrence. Making due allowance for fire, it is estimated that these two age-classes were more or less completely destroyed by livestock on approximately one-third of the area originally covered. The same classes have since been identified on the Prescott, Sitgreaves, and Apache Forests, but no estimate has been made of the damage. Scattering seedlings of younger ages were also found in 1908. These were generally damaged and have since disappeared, except in a few localities.

In 1910 considerable numbers of 1907 and 1909 germination appeared in places. There were heavy losses from natural causes, but a few survived and they were practically all eaten by stock.

In 1914 stands varying from light to heavy sprang up pretty much all over Arizona and New Mexico. Some excellent reproduction of this age-class remains on the Santa Fe and Sitgreaves. On much of the sheep range on the Coconino, Tusayan, Apache, and Sitgreaves, it was practically wiped out. In the midst of the worst damage, fenced areas grazed only by cattle and horses are now well stocked. This is also generally true of open cattle ranges.

A light stand started in 1917. It was exterminated on sheep ranges, but a few survive on cattle ranges and on ungrazed plots.

The year 1919 brought what was probably the best and most extensive seedling crop on the Colorado Plateau since 1882. On sheep ranges at least half is gone, and most of the remainder is severely damaged. On cattle ranges from which sheep are excluded there is considerable damage in certain localities, but on the whole it is much less than where sheep are permitted. Very few seedlings have started on the Coconino and Tusayan since 1919.

From the foregoing it appears that sheep are the worst offenders, although the situation is complicated by the fact that we have no ranges grazed by sheep alone. Damage by cattle is usually confined to areas of heavy overgrazing, especially in the vicinity of water holes and other places of concentration. Next to proper stocking on the range as a whole, the problem with cattle is to obtain proper distribution. Cattle should not be allowed in the forest between late fall and spring, especially when the ground is covered with snow.

Grazing may be beneficial in checking the growth of herbaceous vegetation which competes with young seedlings for moisture and light. Unless excessive browsing can be avoided, however, forest reproduction

is better off with no grazing, because it will usually succeed in spite of competition with herbaceous vegetation.

The benefits from grazing in reducing fire hazard in the Southwest have been generally over-rated. Cattle grazing does remove a large amount of inflammable material; but sheep grazing is much less effective because sheep do not eat the tall bunchgrasses. To remove enough of the ground cover to prevent rapid spread of fires usually requires overgrazing with its attendant ill effects on forest reproduction and soil. Moreover, the worst fire danger is in logging slash or in young stands of trees where the ground is covered with leaf litter.

Grazing does not appreciably favor germination by trampling seeds into the soil, as is commonly supposed. Nature takes care of this by the checking and heaving of the soil. Tramping by stock is decidedly detrimental in wet weather, in that it packs and puddles the soil. At such times seedlings are also destroyed by tramping, although ordinarily they are very resistant to this form of abuse.

According to grazing specialists, excessive damage to forest reproduction is usually associated with overgrazing. This apparently applies to cattle grazing, but does not promise a practical solution to the sheep problem in the Southwest. The theory that stock do not eat forest seedlings unless starved to it assumes that seedlings are distasteful or at least are not relished. There is much evidence to indicate that not infrequently sheep prefer seedlings to grass. It is a common observation that pine seedlings are defoliated when the coarser bunchgrasses, such as *Festuca arizonica,* are practically untouched, and the better bunchgrasses, such as *Muhlenbergia gracilis* and *Blepharoneuron tricholepis,* are but lightly grazed. Severe damage has been found even where the leaves of such excellent short grasses as blue grama (*Bouteloua gracilis*) and black sporobolus (*Sporobolus interruptus*) stand two inches high and many seed stalks remain. White fir (*Abies concolor*) is eaten in preference to yellow pine. The only coniferous species which have been found to be immune in the Southwest are the junipers and in less degree the blue spruce.

It should be added that the liking of sheep for pine and fir seedlings is not always evident. Sometimes, even where the better forage is short, the seedlings are almost ignored and again under similar or better forage conditions they are stripped of needles. Perhaps there is something in the suggestion often made that sheep crave a certain amount of "browse" which is absent from many of the southwestern ranges. It is also probable that their appetite varies from time to time.

On the whole their behavior has been such that they are not to be trusted. No doubt a reduction in numbers to a point where only the very choicest forage is demanded would decrease the damage. This does not mean that the appetite for pine would disappear, but rather that one sheep would eat fewer seedlings than three or four. With a stocking of about one sheep to 30-40 acres, perhaps the damage would not be intolerable. Where reproduction has taken place on sheep range in the past, it apparently has been with this kind of stocking combined with unusually favorable conditions as to seed supply and moisture. Whether the adoption of such a standard of forage utilization would be effective and acceptable to stockmen remains to be determined. From the forester's point of view exclusion of sheep, together with rigid control of cattle, offers the only safe remedy. It is not my desire to discourage investigations, but it seems questionable whether natural reproduction on millions of acres of pine land should be left at the mercy of sheep, pending the results of further experiments which may have to run another twenty years.

THE INCOMPATIBILITY OF FORESTRY AND GRAZING

There is no good reason to believe that the problem of adjusting grazing to silviculture can be more successfully solved in this country than it has been in Europe. Contrary to the usual impression, grazing is not prohibited in all European forests. This is because of the existence of ancient grazing rights and mixed ownership of land, which often render the forest administration powerless to exclude stock. It is not likely that European foresters who have struggled with this problem for centuries have overlooked any opportunities to obtain relief by proper management of stock. Their conclusion that grazing and forestry are fundamentally antagonistic is not a mere dogma but a conviction based on generations of experience. European literature on this subject shows some disposition to tolerate cattle grazing under rigid restrictions, but sheep and goat grazing are universally condemned. In Sweden it is considered better to sacrifice timber growth entirely on certain areas than to allow livestock the run of the forests. For this reason selected areas well adapted to forage production are set aside for this purpose, and subjected to very intensive grazing management including proper stocking, reseeding, and even fertilizing.

The idea prevailing in this country that grazing and forestry can flourish side by side without conflict has probably grown out of the fact that the forests in which grazing is important are of an open character,

and it has been assumed that this is a natural condition. As has already been explained, this is usually an artificial condition brought about by fire and often perpetuated by grazing. In the Southwest there are many thousand acres of open spaces which have lain vacant for fifty years or more, but which under real protection against fire and grazing damage are now restocking. This of course does not apply to areas unadapted to timber growth, such as the large prairies, parks, and wet meadows, but it does apply to nearly all of the small open spaces within stands. It is legitimate to utilize the forage which grows in these openings so long as it does not seriously interfere with forest reproduction. But the success of the livestock industry in the forest depends upon preventing reproduction, because when trees take possession of the soil there can be but little grazing. As foresters it should be our aim to stock every acre of potential timberland so completely that it will produce a minimum amount of forage.

RELATIVE RETURNS FROM FORESTRY AND GRAZING

There is a deep-seated notion among foresters as well as grazing men that where grazing is an established industry forestry must not interfere lest it cause economic upheavel. Curiously enough, this idea prevails in some communities where the lumber industry contributes far more to local business than does the stock industry. In the yellow pine type of the Coconino National Forest the fees received from grazing are about two cents an acre annually, whereas the annual increment in a fairly stocked cut-over stand of yellow pine at average current stumpage rates is worth 30 cents an acre. Translating annual growth of forage and timber into returns to the community, as represented by the f. o. b. selling price of cattle, sheep and wool on one hand, and lumber on the other, the values are less than $1.00 an acre for the forage crop, and $3.00 an acre for the timber crop. In regions where timber grows more rapidly, the differential in favor of the timber crop is still greater. The Coconino National Forest has about 600,000 acres of productive and accessible timberland. Under a crude system of forestry which does little but practice conservative cutting and provide effective protection against fire and grazing, this land is capable of a sustained annual yield of at least fifty million board feet of timber, which will support a permanent lumber industry worth a million and a half dollars a year. The livestock industry on this same land, under present conditions, can yield less than half a million dollars a year. If the forest were clear cut and the land devoted entirely to grazing, it

might, under proper management, be capable of twice its present return; but under intensive management the yield of the forest could also be doubled, and a still further increase will doubtless come from rising timber prices.

According to figures by the Arizona Industrial Congress, the value of the lumber industry in Arizona in 1925 was about five million dollars, and corresponding value of the cattle and sheep industry was a little less than fifteen millions. The saw-timber lands occupy about seven per cent of the total area of the state. Nearly all of this area, including timber lands, is grazed, the only notable exception being farm lands and portions of the lower desert, both classes totaling perhaps fifteen per cent. In other words, seven per cent of the land devoted to timber crops is producing one-third as much wealth as twelve times this area devoted to grazing. The forests of the state are capable, under intensive management, of supporting a lumber industry worth nine millions of dollars a year, without taking into account a probable rise in lumber prices. Because of the overgrazed condition of nearly all grazing lands in the state, the range livestock industry is bound to decline. It is not improbable that the present generation will live to see the lumber industry of Arizona surpass the grazing industry in point of wealth produced.

These comparisons between grazing and forestry are made, not with the idea of belittling the stock industry, but in order to show that if grazing is permitted to damage the forests, a major resource is being subordinated to a minor one. The situation on the Coconino National Forest differs from that on many others in the West mainly in that transportation facilities favor more immediate exploitation of timber resources on the Coconino. Where logging can not be advantageously practiced at present or in the near future, there may be justification for favoring reasonable grazing as a temporary measure; but there can be no justification for grazing conducted in such a manner that it destroys the future forest, undergrowth, and soil.

The indirect values of a forest cover are often greater than both the timber and grazing resources. This is clearly recognized in the case of watersheds. Recreational values are rapidly coming to the front, and in many localities they already exceed the grazing values. Let it not be supposed that a forest can long be overgrazed, the undergrowth destroyed or mutilated, the lakes, streams and springs disfigured and polluted, and still retain the natural charm which each summer lures millions of people from the cities into the woods.

Abuse of the forests by grazing is all the more indefensible when we consider the relatively small amount of forage produced by real timber lands. The usual plea is that the forests are needed for summer grazing. How much they are needed throughout the West, the writer is not prepared to say. In Arizona, however, contrary to the common belief, the woodlands below the true timber zone and the so-called "desert" down to an altitude of 3,000 feet are capable, under proper use, of producing more palatable forage acre for acre than the timber lands. This is true for every month of the year, except possibly May and June. The trouble with the lower ranges in the Southwest is that they have been ruined by overgrazing. If these lands were revegetated and used conservatively, they alone would carry more livestock than is now carried by pasturing both timber and grass lands.

CONTROL OF GRAZING

Control of grazing is essentially an administrative problem. If the timber crop is given primary consideration, the research aspects of grazing become relatively simple. If timber production is truly the major objective, forage production *on timber lands* can scarcely be even a secondary objective for then whatever grazing is afforded must be regarded as purely incidental and temporary. Grazing must be subordinated to such an extent that there will always be a substantial margin of safety on the side of the forest. This will usually result in incomplete utilization of forage. If we attempt to graze to a dead line beyond which forest reproduction can not take place, there will be no end of research problems, because the amount of grazing which can be tolerated is seldom the same in two localities, nor does it remain constant in the same locality from year to year. The inevitable consequence will be too much grazing for the good of the forest.

Where control measures involve large reductions in the number of stock, decades may be required to make the necessary adjustments without undue hardship to the stock owners and disturbance of local economic conditions. For this reason it is usually better to plan reductions and exclusions far in advance instead of waiting until an emergency exists and then attempting to remove large numbers at one stroke. In regions where good seedling crops come at long intervals deferment of action until serious damage becomes evident usually means that, before remedial measures can be put into effect, the seedlings will be destroyed and reproduction will be delayed another twenty years. Wherever the forage in an understocked forest is fully utilized, it is

inevitable that the stock industry must face drastic reductions sooner or later. If forest reproduction is being injured, silviculture will demand a decrease in the number of animals; if forest reproduction is not being injured, the young trees will shade out the forage and a decrease in the number of stock must follow automatically.

The regulation of grazing in the National Forests should be absolutely in the hands of the Forest Service. When damage is found to be taking place, it should be within the power of forest officers to act promptly. The usual procedure of consulting with stock owners and, after a year or two of delay, adopting some compromise measure, may promote harmony but it is poor forestry. If grazing is permitted at all on areas in the process of regeneration, arbitrary action on the part of forest officers is often going to be necessary. Permits to graze on such areas should be granted only on the condition that they are subject to reduction or cancellation on short notice. No doubt this will result in depreciating the value of forest range. The answer is that grazing on a large scale can not be made permanently attractive on lands dedicated to the growing of timber. In view of these circumstances one must look with apprehension upon measures designed to stabilize grazing in the National Forests. By the very nature of things, grazing can not be stabilized on a basis satisfactory to stockmen if timber, soil, and water resources are to be properly safeguarded.

There appears to be only one way to avoid arbitrary and perhaps confiscatory action, and that is to carry enough surplus range so that when it becomes necessary to reduce or eliminate grazing on any area, the permittee can be moved to another allotment. In order to make such a plan workable it would probably be necessary for the Forest Service to acquire ownership of permanent improvements such as fences and water developments. When we consider the low carrying capacity of many forest ranges during the reproduction period and after reproduction is established, it becomes doubtful whether this would be a sound investment, especially in regions where water development is expensive.

In pointing out some of the shortcomings of the grazing administration in the National Forests, the writer is not unmindful that they are to a large extent the result of circumstances beyond the control of forest administrators. Grazing was an established industry in practically all the forest regions before American forestry came into being. Communities in remote timber regions are even now, in the absence of transportation facilities necessary for timber exploitation, dependent

upon the grazing industry, and will be so for years to come. It has not been wholly through disregard of forestry that timber growing has been set aside in the interest of stock growing. The great danger which foresters must avoid lies in mistaking artificial and temporary conditions for the natural and permanent, and in allowing their vision to be distorted by false standards. Economic conditions make it impossible to practice forestry in this country today as it is practiced in Europe. But we must not forget that certain economic and physical laws are the same the world over. One of these is that the permanent prosperity of a nation demands that its land be put to the highest use; another is that full crops of trees and grass can not grow on the same soil.

The solution of the grazing problem should follow constructive lines. Distinction must be made between true timber lands and lands chiefly valuable for grazing. On the latter, range management should be developed to a high degree, with due consideration of soil and water resources. Ordinarily the area of such lands within National Forests should be small. On the former there should be no attempt to increase grazing capacity, but rather to decrease it by replacing grass with trees. Reforestation may require many years, in which event the forage crop will be considerable. To what extent this may be utilized without retarding reforestation will depend upon many circumstances, and should be made the subject of investigation in every region. Where the demand for grazing land is great, there will be a tendency to overgraze. There should always be a substantial factor of safety on the side of forest reproduction, regardless of whether the forage is fully utilized. In regions where reproduction comes easily, or where, perchance, seedlings are not eaten to a great extent, these conditions should be known so that grazing may not be unnecessarily curtailed. Moreover, there are possibilities of employing grazing as an aid to reproduction. Except in extreme cases, the problem can not be dismissed by deciding that grazing is destructive and must be eliminated, or that it does no damage and therefore requires no attention. We shall probably always have some grazing on timber lands. The day of the large outfit in the forest is passing, but there will always be the farmer with a few head of cattle, and possibly other small owners whose living in the woods is to be encouraged. The solution is to begin now and work steadily on reductions or class exclusion as circumstances require, with a view toward doing away with overgrazing. Understocking rather than full stocking should be the aim, and the criterion of proper stocking should be elimination of damage to reproduction and soil rather than utilization

of forage. Having reached this goal, there will still be cases of local damage. To handle these effectively, forest officers must be constantly on the alert, trained to detect damage in its incipiency, and clothed with authority to act without delay.

FOREST PRODUCTS RESEARCH AND PROFITABLE FORESTRY

By Aldo Leopold
Forest Products Laboratory

A few years ago the outlook for commercial forestry might have been expressed thus: "Wait a little longer and the price of stumpage will rise to the point where it will pay to grow timber as a crop."

Today the outlook for forestry has undergone a radical and perhaps beneficial change. The present situation may be expressed in the phrase: "Increase the value of forests so it will pay to grow them."

The old watchful waiting concept was premised on the assumption that timber shortage would automatically raise stumpage prices. That assumption failed to allow for the competition of substitute materials, which, together with over-production and other secondary evils, has built or is building a definite ceiling above which prices can not rise without loss of markets.

On the other hand the cost of timber growing (or timber-holding, as the case may be) constitutes a more or less fixed floor below which prices can not fall.

The margin of profit on which commercial forestry depends must be found somewhere between that floor and that ceiling.

But how?

The only way to find a margin of profit which does not already exist is to learn by research how to get bigger yields or better quality or both. If we can grow more timber per acre in a given time, or if we can make it render better service, we add to its value, as distinguished from its price, and the price ceiling is not operative as an obstacle. It is always possible to get a better price for better service-value. That is why I say: "Increase the value of forests so it will pay to grow them."

Bigger yields and better quality are attainable through what are ordinarily considered to be two kinds of research, silvicultural and products. This paper is an attempt to appraise the possibilities of products reasearch as a means of increasing the value of forests.

OBJECTIVES OF PRODUCTS RESEARCH

It is often erroneously assumed that the principal object of products research is to find ways of utilizing waste. This error probably

arises from the fact that the waste pile is so easily dramatized. President Coolidge's famous aphorism: "Reduce wood waste—a tree saved is a tree grown"—does this excellent effect.

But catch phrases for popular education are one thing, and accurate objectives for research another. To cut down the waste pile is, to be sure, a primary objective but it is only one of several, and the others carry promise of an even greater importance to forestry.

All of the objectives of products research, including waste prevention, can be expressed thus:

1. To increase the quantity of merchantable forest products by utilizing waste.
2. To enhance the quality and hence the value of forest products by:
   (a) Controlling the properties of the material grown through manipulation of the growth process.
   (b) Sorting the material to segregate the properties required in each use.
   (c) Modifying the properties where sorting is not sufficient.

Since 2(b), sorting or grading for properties, offers the most immediate chance for enhancing the quality and value of forest products, let us discuss it first. For simplicity, let us consider lumber alone.

GRADING FOR PROPERTIES

Present lumber grades usually segregate only one "property": Knots or visible surface defects. That this segregation increases values is indicated by the fact that graded lumber sells for more than ungraded. Could values be further increased by segregating any of the other thirty properties of lumber?

Probably they could in many instances. [1]R. C. Tuttle expresses very aptly in this way: "The outstanding advantage of most substitutes for wood is their uniformity.

"The outstanding handicap of wood is its variability.

"The variability of natural-growth wood, which is a handicap can be converted into versatility, which is an asset, by means of selective tests." For example:

A hard dense board can be distinguished from a soft, light one of the same species and dryness by lifting it, looking at it, bending it, cutting it, or denting it.

[1] "A Program of One Hundred and Ten Research Projects Bearing on the Proper Use of Wood and Other Forest Products," Forests Products Laboratory report, October 23, 1926 (unpublished).

The hard board would obviously serve best in a floor and the soft board in a wall.

Present grading rules do practically nothing to allocate either to the use where it belongs, or to exclude either from the uses where it does not.

Tuttle joins these three truisms together, and asks whether it would not increase lumber values if the public were able to buy all-hard flooring; all-soft insulation or coverage. It probably would, provided simple, inexpensive criteria for sorting be devised.

How much grading for properties might add to the value of lumber is of course difficult to predict. Hardness is only one of many properties which might be isolated, and realized upon, by better grading. Strength is already beginning to be graded in structural timbers. Durability is to some extent indirectly graded by heart specifications in ties and timbers. But such vastly important properties as workability under tools, stability under moisture, paintability, insulation, combustibility, and gluability are still selected only by species or not at all, in spite of the fact that the variation within one species is often as great as the difference between two. It should be entirely possible for research to devise means of grading these properties. If all these then, or even a part of them, could be delivered to the consumer with the certainty and uniformity obtainable in standardized substitutes it might constitute a substantial addition to the intrinsic value of forests. Many synthetic products actually consist of merely one desirable property, like insulation, isolated and made uniform. Yet a foot of this one property commands a price nearly equal to a foot of lumber containing half a dozen properties equally desirable but of uncertain mixture.

Grading for properties may add not only to intrinsic forest values, but also to the public's willingness to pay for them. Tuttle points out that the buyer demands not so much what he needs as what he can get. He did not demand insulation when it was not on the market as such. He demands it now because synthetic products have made it available in isolated form. He actually needed insulation worse before he knew there was any such thing. He may demand each of the 30 properties of wood, and pay for them, if good forestry and good merchandising make them available.

There is, of course, an economic limit to profitable grade diversification. It will be higher in valuable than in cheap material. That this limit is not yet operative is indicated by the present practice of remanufacturing to raise grade. There are planers which buy southern

pine on grade from portable mills and by remanufacture contrive to raise the percentage of uppers from about 20 to about 35 per cent, thereby raising log run sale value about 22 per cent. There is, of course, an element of unearned increment in this figure, but it is nevertheless suggestive of what better grading might do.

One of our great handicaps today is that we must demonstrate forestry in deteriorated forests. Profits lie in quality; we have little but quantity left to work with. Money comes from grade yields; our timber comes log run. Markets demand long rotations; expenses demand short. Is not the unutilized opportunity for qualitative selection the proper seat from which to grab both horns of this dilemma? I think it is, but only research can keep us in it.

Tuttle predicts that we shall soon cruise timber in terms of properties as well as in terms of board feet log run. Certainly properties are the closer criterion of salable value. If we are to evaluate stands in terms of their properties, is it not thinkable that we might evaluate growth and yield in the same units?

GROWING WOOD OF DESIRABLE PROPERTIES

The idea of "growing properties to order" by manipulating growth conditions originally arose from the attempt to select wood of certain properties from existing stands by noting what growth conditions were usually associated with the properties desired.

How to grow wood to order has been worked out for a few species. Paul has roughly determined the conditions necessary to produce strong ash and hickory, and shown that they can be controlled by manipulating thinnings. He has tentatively determined the growth conditions producing heavy and light southern pine. The indications are that its weight depends on both site and thinnings, although this is being further verified on controlled plots.

We know, then, something of how to grow properties in three woods. The remaining 47 commercial species are an unfinished task of products research. As an extreme case of how much forest values might be raised by growing properties to order, Newlin estimates that if we had a stand of ash known to be of airplane quality it might be worth $15 more per M on the stump than ordinary ash.

As an extreme case of how much value is wasted when the properties of standing timber are unknown, consider a stand of Sitka spruce which is being cut for airplane stock. Only 10 per cent of the lumber passes inspection as airplane stock, and only 2 per cent is finally used in planes.

So far research in the deliberate production of properties has dealt only with trees. It must next deal with stands, at which point it becomes the proper task of the Forest Experiment Stations. It will often be difficult to decide what property to grow. Take hardness in southern pine. A thick stand of small crowns on strong soil produces a preponderance of hard structural southern pine; an open stand of large crowns, a preponderance of soft insulation and coverage. Hardness and softness, when thus isolated, are both salable properties. Which is the more profitable to produce on a given acre? The answer depends on how much of either that acre will produce in a given time, and their probable relative future values. Here is a problem in economics and the mensuration of stands which is just as important and difficult as the original problem of response of wood properties to the environment of the tree.

It is important to keep in mind that while hardness and softness are, because of their simplicity, convenient properties with which to illustrate the idea of selection and control, they are not necessarily the most important ones to actually grow to order. Control of many others becomes a possibility through the application of genetics. The recognition of genetics as one of the foundations of silviculture is the greatest recent advance in forestry, and at no point can genetics lend more potent support than in growing wood to order. Bates [2] has pointed out that not only tree form but also susceptibility to defect-producing diseases and parasites are probably inherited characters. It is not improbable that spiral grain and curly figure are inherited. It is probable that oleoresin production varies in different strains of the same species, and that the dual purpose pine presents the same opportunity to genetics as the dual purpose Durham. It is even possible that the fiber properties which limit the amount and quality of pulp yield can be manipulated by genetic selection within a species.

We have here nearly the whole gamut of qualities and hence value in wood, all probably susceptible of being produced or reduced at will by applying to the art of silviculture the results of research in genetics and wood properties. Schenck says: "Forestry is the outcome of local and peculiar conditions, many of which are absent *and will remain absent* from the U. S. A." Can we not rather say that while European forestry may have been the outcome of such conditions, American forestry can be the outcome of bending economics to the public will by applying the force of science?

[2] "Better Seeds, Better Trees," by C. G. Bates, Journal of Forestry, February, 1927.

MODIFYING THE PROPERTIES OF WOOD

The properties of wood have been modified naturally since the first bow stave was left to season, and artificially since the first house was painted and the first pole or tie was impregnated with a preservative. There is nothing new about the idea as such, but there is much new evidence to indicate that its potentialities in making forestry profitable have been barely touched.

The most important of all wood properties is its propensity to swell and shrink with moisture changes. When controlled it is a great asset; when uncontrolled it is a great fault. Control of any phenomenon often follows but seldom precedes an understanding of its mechanism. The mechanism of moisture movement in wood is now partially known. It is not unreasonable to hope that at least partial control of swelling and shrinking may follow.

Control of phenomena also often follows but seldom precedes the ability to measure them. Instantaneous measurements of the quantity of moisture in wood are now a laboratory fact, and measurements of moisture per cent may soon follow. Place in the hands of the lumber-using public a convenient yardstick for measuring its dryness and you abolish at one stroke one of the most potent causes of substitution—green lumber sold as "commercially dry." Moreover, you avoid injustice as between groups of producers because there is no question of any one group setting the pace of self-reform. All are automatically and simultaneously on a parity.

Modifying hygroscopicity exemplifies a new venture. Modifying durability is an old venture needing extension into new fields, especially into the building field. Durability treatments also need to be combined with fire-proofing and insect-proofing treatments. The recent epidemics of termites emphasize this need. Certainly it will add value to lumber and hence forests if wooden houses are made durable, fire-retardent, and termite proof. Of course it will also add cost. It is the task of products research to make the value exceed the cost. The idea of extending durability treatments into the building field is rapidly gaining currency and needs no detailed exposition.

Modifying the effectiveness of properties by better design is likewise an old venture needing extension into new fields. Research has doubled the strength of the wooden box without increasing weight, or halved weight without decreasing strength. Why not try our luck at houses, furniture, athletic goods, or even the lowly cowshed? We tend

at times to pass up the everyday use in favor of the exceptional. Who knows how to design a barn? What joist and lumber sizes and spacing give maximum rigidity with minimum material in a floor? It is a fact that the airplane rib was improved before this lowly task was thought of. This was because there happened to be special funds for airplane work, but even so the safety razor should teach us that there is a tendency to overlook the commonplace. Better cowsheds mean more valuable forests.

Insulation is a property in which wood excels but it can probably be further enhanced artificially. The way to enhance it is probably to examine what we put on wood rather than what we put in it. Should we paint the back of sheathing with something to throw back rather than absorb escaping heat? What determines the acoustics of the noisy bathroom? Private enterprise has attacked and partially solved the latter problem in better wood use, and private enterprise may safely be relied upon to perform a great part of these many tasks. But there are others which are unpatentable or otherwise lack incentive to private effort. These are the proper fields of public research agencies.

CONCLUSIONS

The competition of substitute materials makes it necessary to look to the purposeful enhancement of wood values by research, rather than to try automatic use of wood prices, as the basis for profitable forestry.

There are large opportunities to enhance values through research in forest products. These include not only the utilization of waste, but also improvement of particular properties, either through manipulating the growth process itself, or by segregating or modifying the desired properties after the wood has been cut.

Better segregation offers the most immediate chance to raise values, but ultimately the biggest opportunity is found in the application of genetics to the selection of growing stock and in the manipulation of growth conditions. Genetics can not improve wood properties, however, without products research to isolate and identify the properties to be grown.

Enhancing wood values by growing, grading, and modifying properties is a big but by no means impossible task. Obviously it must be performed bit by bit. Concentrate research upon it, encourage each little change that trends in that direction, discourage each little change of contrary trend, and results may come fairly quickly. More quickly, at least, than watchfully waiting for timber shortage to raise prices in the face of substitution, deterioration, and overproduction.

EFFECT OF PASTURAGE ON WHITE PINE REPRODUCTION AND ON TIMBER QUALITY

By H. J. Ninman and W. C. Thompson
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Because of the lack of reliable data on the reproduction and growth of timber trees in pastured areas it was determined to make careful observations from a pathological standpoint on small white pine trees in a dense stand on a one-half acre plot and also on white pine trees in the semi-mature stage in a dense stand on a one-fourth acre plot, as well as on trees of other species. The object was to suggest the importance of further study with respect to grazing rather than to furnish conclusive evidence. The two plots were separated by a wire fence, and were located at Eau Galle, Wisconsin.

Farming on a small scale began in the vicinity of Eau Galle about sixty years ago, but until about 1900 the people depended much upon lumbering. Since 1915 the dairy industry has become the leading pursuit in agriculture, and lumbering is at this writing of but little importance. Parts of the farms on which the plots were located were cleared many years ago, but only during the past twenty years has the number of cattle been increased for dairy purposes from which a considerable cash return was secured, and apparently only during a period of about twelve years previous to the observations here considered were there enough cattle and horses on the pastured part of the farm to cause much damage to the pines and other timber trees.

The 60-acre area in the southwest corner of which the reproduction plot was located, and which was a pasture of a larger farm, was grazed by twelve mature cows and three horses. Although the plot was located near the Eau Galle river and was a part of the pasture which the livestock crossed in going from the farm and the main part of the pasture to the river, water was available on a half-mile shore line so that the plot was representative of other areas bordering on a river. Located in the northwest corner and nearly a half mile north of the plot an area of five acres of the pasture was sand wash with no vegetation; about 25 acres, mostly on the slope along the river, was a mixed growth of all sizes of pine and hardwood with a fair growth of grass and white pine reproduction; and the remaining 30 acres of the pasture

east of the river bank were mostly cleared and contained good grass and clover sod on sandy loam soil.

The half-acre plot, 120 by 180 feet, was located on the property of F. M. Welch on the east bank of the river with the western boundary about 100 feet from the shore. About two-thirds of the plot had a western slope of 20 degrees, the remainder, at the top and bottom, had a more gentle slope. A slope was selected because such land is not well suited for cultivation by machinery and is frequently reserved for pasture and woodlot. The soil was sandy loam, ideal for growing white pine and sufficiently heavy for poplar, birch, maple and oak. In most places the pine needles, dead hardwood leaves and humus covered the ground to a depth of two inches. There was a rather sparse growth of grass, but there were some patches of sod. Plantain, partridge berry, poison ivy, small oaks and small poplar composed much of the undergrowth. The white pine trees under twenty years old numbered about 3,000 per acre. In places they were so close together that the cattle did not graze among them. There was no dense brush to serve as a barrier to livestock or to protect the small pines. The cover trees as listed in 1923 were as follows:

No. and Species	Average D. B. H., Inches	Average Height, Feet
39 Poplar	7.6	38.0
31 *White Pine	9.4	45.4
21 White Birch	6.1	49.3
13 Burr Oak	6.2	47.7
12 Red Oak	9.5	47.1
3 Ironwood	2.0	15.0
1 Maple	7.0	50.00

* Three white pine seed trees each 33″ D. B. H. and 70′ high.

The storm on June 22, 1924, blew down the following diseased cover trees, which damaged much reproduction: three poplars, weakened by heart rot; five oaks, weakened by heart rot; one birch, weakened by root rot; one large white pine, which had shallow roots. The shade caused by the cover trees varied from 0.0 to 0.4[1] in various parts of the plot, which allowed sod to form in some parts. On account of the west slope, sunlight did not strike the greater part of the plot until after 9:00 o'clock in a summer morning.

The plot was measured and marked in September, 1923. Observations on each white pine tree under twenty years old were made with

[1] Complete shade all day is rated at 1.0.

respect to the conditions and to causes of injuries as follows: The general condition of the tree; diameter at the base, height, age, shade, annual height growth for 1921 and 1922; injury to the leader, to the branches, to the trunk, to the roots. In 1924 the same kind of observations were recorded for each tree except that the annual growth for 1923 and 1924 (up to August 1) were taken. The number of trees by age and their average height as recorded in 1924 is shown in Table I.

TABLE I

Height of White Pine Reproduction

Age	Number of Trees	Average Height Inches	Age	Number of Trees	Average Height Inches
1	12	1.6	11	47	21.4
2	13	2.8	12	42	24.9
3	66	3.4	13	86	32.2
4	77	5.0	14	78	48.7
5	120	6.2	15	138	52.3
6	101	7.9	16	132	62.0
7	144	10.0	17	117	77.8
8	98	12.5	18	33	83.4
9	93	14.7	19	7	72.3
10	68	19.8	20	3	94.7
				Total 1475	

The average annual growth for four successive years was as follows: 1921, 3.59 inches; 1922, 1.66 inches; 1923, 3.74 inches; 1924 (up to August 1), 1.86 inches.

The plot was not selected for the purpose of determining average growth under normal conditions. The average height here given is not comparable to measurements as usually made[2] where only those trees are considered which are expected ultimately to constitute the woodlot. In this plot every tree, good and bad, from one to twenty years old was measured.

The results of the 1924 observations of injuries to white pines under twenty years old due to livestock, calculated on the total number of trees and expressed in per cent, are shown in Table II.

In Table II the item "bent down-hill" refers to a condition where livestock at some time had a path near and at a higher level than the base of the tree and gradually forced earth against the lower part of the stem so as to bend it over, after which the tree grew upright but

[2] We only wish there were something resembling standard practice in this respect.—ED.

TABLE II

Percentages of Live White Pine Trees Injured by Live Stock

	Leader	Branches	Trunk	Roots
Dead	1.60	6.50	0.00	0.00
Scarred	0.07	2.34	17.25	0.67
Bent down-hill	0.07	0.00	7.69	0.39
Trampled	0.00	0.00	0.07	1.07
Broken	1.20	3.45	0.00	0.00
Crooked	0.00	0.00	1.33	0.00
Exposed	0.00	0.00	0.00	1.74
Injured—Total	2.94	12.49	26.27	2.87
Normal trees	69.20	49.80	58.99	96.60

the roots were left in danger. It was observed in the plot, and also in many other places, that small pine trees in this condition were thereafter uprooted by the hoofs of livestock with great regularity. The zig-zag path on a hillside lengthens the distance and multiplies the damage to the trees. Frequent changes in the location of paths, largely due to fallen trees, further increases the damage.

Of the total number of live pine trees in both 1923 and 1924, 17.2 per cent had scars on the trunks due to livestock. Of the total number in 1924, 7.16 per cent had scars at the base, of which the great majority were on the up-hill side. Scars near the base of the trunk serve as places of entrance, at vital points, for heart rotting fungi which ultimately kill or destroy the usefulness of the tree.

Injuries to the branches were found to be most common on trees from three to seven feet high. Not only does the cow brush along the side of and over the top of a tree, but often purposely rubs her head and horns against the tree and switches it about vigorously in order to rid herself of flies. Some branches are broken so that stubs several inches long are left on the trunk. In other cases the whole knot is torn out of the trunk, and with the branch a large piece of bark is removed from the tree. When the trunk becomes injured the tree is physically weakened, and the injuries offer places for borers to enter and further weaken the tree. Fungus diseases sometimes appear in such wounds, but they do not seem to be particularly destructive on the young pine stems except at the base. The study of root injuries was handicapped by the fact that the roots were not exposed to view, and therefore the root injuries were probably underestimated.

Frequently when the branches on one side of the tree are injured the remaining ones are stimulated to a rapid growth so that they develop in size about equal to the main trunk, which ultimately results in an un-

symmetrical formation. Damage to the leader by livestock is not a serious factor, because the leader is flexible and not easily broken off.

Of the live pine trees recorded in the half-acre plot in 1924, 31.9 per cent were in a perfectly normal condition, and 26.8 per cent were injuried in some respect by livestock, some of the trees being injured in several ways. At first thought the injuries on 26.8 per cent of the number may not seem particularly harmful, but attention should be called to the fact that the number of trees is much greater than in a usual stand of reproduction. Injury to white pines by livestock is proportionately more common where the trees are scattered than where they are close together because more grass grows in the open spaces. Because of these facts pine trees become fewer where few exist, and therefore large open spaces are made in some places while clumps of trees remain in others, which is an unfavorable condition to a woodlot.

Besides the injuries to young pines by livestock, the injuries due to fallen trees, 14.00 per cent, and injuries of the leaders caused by insects, 14.82 per cent, were the most serious.

In order to secure information as to the damage by livestock to trees of timber species in the semi-mature stage, a plot was selected directly south and just over the line fence from the reproduction plot above described.

The plot 100 feet x 109 feet (.25 acre) was similar to the reproduction plot as to position with respect to the pasture and the river, slope, soil ground covering, and species of trees and plants, except that the grass was sparse due to greater shade density, which varied from 0.1 to 0.6. On the bordering land fifteen mature cows were pastured on 50 acres. The cattle usually went down the slope through this plot to the Eau Galle river twice per day. When they could see the water the leader would start to run down hill, and the rest would follow. The

TABLE III

Average Size and Age of Trees of all Species

	No. of Trees	No. Dead Trees	Average D. B. H.	Average Height	Average Age
White Pine	135	12	4.2	31.4	36.9
Black Oak	20	3	8.2	31.5	51.8
Elm	1	0	2.2	12.0	30.0
Maple	2	0	8.0	37.5	50.0
Ironwood	3	0	1.6	15.3	31.6
Poplar	40	2	7.7	46.7	41.3
White Oak	1	1	3.0	14.0	40.0
White Birch	3	1	8.6	25.0	41.6

soil was pushed downward at every step, the dust flew, and the roots of the trees suffered.

The observations were made on July 23, 1924. The number of trees by species, the average measurements, and the approximate average age of the trees are given in Table III.

Relative to the injuries and the condition of the trees, the results of the observations are given in Table IV.

TABLE IV

Number and Percentage of Defective Trees of all Species

	Number	Per cent
Total trees	205	100.0
Dead trees	19	9.3
In good condition	29	14.2
In fair condition	39	19.0
In poor condition	118	57.5
With basal defects	95	45.5
With frost splits	16	7.8
With heart or root rot	68	33.1
With heart or root rot at the scar	53	25.8
Scarred by livestock	83	40.5
Scarred by livestock with rot at scar	43	21.0
Scarred by livestock, up-hill side	60	29.2
Scarred by fallen trees	12	5.9
With roots exposed by livestock	32	15.6

It is frankly admitted that mistakes as to the cause of injuries were probably made; nevertheless, the poor condition of the great majority of the trees on the plot shows that the present practice of over-pasturing the woodlots is highly detrimental to the timber and that neither a good grade of timber nor a high yield can be expected where excessive grazing is practiced.

THINNING YOUNG RED PINE

By Joseph Kittredge, Jr.
Lake States Forest Experiment Station

An experimental thinning was made in June, 1923, in a dense stand of 15 to 20-year-old red pine on the Minnesota National Forest.[1] The object of the experiment was to determine what effect a thinning from below, which removed the poorest trees, would have on the development of clear boles and on the rate of growth. One plot, 100 feet square, was thinned and all the trees left after thinning marked with numbered tags. The other adjacent plot was left unthinned and only 100 trees of about the same diameter, 1.5 to 1.9 inches, as the average tree on the thinned plot, were tagged. Both plots were completely destroyed by a crown fire on May 16, 1926, and were remeasured five days after the fire. If the fire had any effect on the measurements, it was to reduce them. This would tend to make the following absolute growth figures conservative but should not appreciably affect the comparisons between thinned and unthinned plots. Since certain results appear even for the two growing seasons[2] following thinning, it seems worth while to make them available and to supplement them with some data from other planted and natural red pine stands of about the same age and different densities, which throw some light on the relation of density to growth.

The thinning plots were situated on a level area of fine sandy soil probably underlain at no great depth by a layer of heavier texture. The soil indicated a better than average site for red pine. The height and development of the old growth not far away also indicated that the site was at least medium and probably a little better than medium for red pine. A small area in this vicinity is known to have been burned over about 20 years ago. Presumably the stand originated on this

[1] The experiment was planned and the 1923 field work carried out by C. G. Bates and H. D. Petheram.

[2] The original measurements were made in June, 1923, when the shoots had just about completed their growth. The fire on May 16, 1926, came before the shoots had made any appreciable growth. The height growth was therefore that which was added in two growing seasons. In a region of light spring and heavier summer precipitation, diameter and volume growth probably continued after June, 1923. However, since definite local information as to the length of the season of growth is lacking, two years has been used in computing the annual growth, although it is possible that some figure between two and three years might represent more nearly the actual period of growth. Even if this were the case, the comparisons between the thinned in relation to the unthinned plot would remain the same.

burn, although there were no large seed trees nearby at the time of thinning. The few paper birches and jack pines, 19 and 20 years old and somewhat larger than the red pines, most of which were 16 to 18 years, were not sufficiently numerous to prevent the classification of the stand as pure red pine.

Plot I had 5,751 trees to the acre in 1923, and Plot II, containing 5,083 trees before thinning, was thinned until only 1,869 trees to the acre were left. The trees ranged from ½ to 4 inches in diameter with an average of 1.8; and from 5 to 23 feet in height, average 13.

The basal areas in 1923 on the unthinned plot were 90.9 square feet, on Plot II before thinning 67.6, and on Plot II after thinning, 34.1. The volumes per acre in 1923 on the unthinned plot were 747.6 cubic feet, and on the thinned plot 864.1 cubic feet before thinning, and 467.3 cubic feet after thinning. Volumes were computed by the use of a local volume table prepared on the basis of analyses of the trees removed in thinning. The thinning removed 63 per cent of the number of trees, one-half of the basal area, and 46 per cent of the total cubic foot volume. Owing to the theft of a few of the tags and the impossibility of distinguishing with certainty trees which may have been dead before the fire, the comparisons of growth are based only on the 325 tagged trees of the thinned plot and the 95 tagged trees of the unthinned plot which could be certainly identified. The growth figures are, therefore, gross and make no allowance for mortality. Before the fire casual observations of the plots left the impression that there had been little mortality in either of them. Almost certainly, however, the losses by trees dying were heavier in the unthinned than in the thinned plot, a difference which would tend to emphasize the benefits of the thinning if the net growth rates could be compared.

The average current annual diameter increment per tree by D. B. H. classes in the thinned plot was as follows:

D. B. H. Class, Inches	Diameter Increment, Inches
0 —0.4	0.16
0.5—1.4	0.19
1.5—2.4	0.18
2.5—3.4	0.19
3.5—4.4	0.26

Comparing the growth of 0.18 for the D. B. H. class, 1.5 to 2.4, following thinning with that of the unthinned plot where it was only

0.08, the diameter growth increase on the thinned plot was 8.7 per cent, and on the unthinned, only 4.0. The other interesting fact in these figures is that the largest diameter class, 3.5 to 4.4, showed the largest actual diameter increase, 0.26 inches, but this increase when expressed as a percentage of the class average is considerably less than that of the smaller classes. If it is assumed that the 95 trees of average size in the unthinned plot represent the average growth for that plot, the average annual diameter growth per tree without thinning was 0.08 inch or an increase of 4.1 per cent, as compared with the thinned plot in which the average growth was 0.19 inch or 10.3 per cent increase.

The average current annual height growth per tree for the last two years by D. B. H. classes on the thinned plot was as follows:

D. B. H. Class, Inches	Height Growth, Feet
0 —0.4	0.5
0.5—1.5	0.7
1.5—2.4	0.9
2.5—3.4	0.8
3.5—4.4	0.2

The average for all classes is 0.8 feet per year which corresponds exactly to the average for the numbered trees from 1.5 to 2.4 inches D. B. H. in the unthinned plot. For the two years following thinning, height growth was not stimulated by the thinning. The other interesting fact in these figures is that the height growth was greatest, 0.9 feet, in the 2-inch diameter class where the vigorous codominant and intermediate trees which had begun to feel the effect of crowding, were found. Little stimulation resulted in the largest trees which had had ample space for growth and little in the smallest trees which had been crowded to the point where they did not quickly recover from the suppression.

The average tree in the unthinned plot with a volume of 0.13 cubic feet in 1923 had increased to 0.17 cubic feet in 1926. In the thinned plot, the corresponding figures were 0.17 and 0.25. Expressed as current annual increment per cent by D. B. H. classes, the figures are:

D. B. H. Class, Inches	Growth Per Cent
0.0—0.4	300.0
0.5—1.4	32.7
1.5—2.4	25.8
2.5—3.4	16.5
3.5—4.4	15.7

The current annual increment per cent for the whole stand following thinning was 23 per cent as compared with 15.4 per cent for the unthinned stand. Comparing the trees actually tagged in the two plots in the 1.5 to 2.4 inch class, those in the unthinned plot had a growth per cent of 13.1 and those in the thinned 25.8 per cent or nearly double. On a per acre basis the unthinned plot increased from 748 cubic feet to 978 cubic feet or 115 cubic feet per acre per annum, while the thinned plot increased from 318 to 467 cubic feet or at the rate of 75 cubic feet per acre per year.

The thinning in a stand where the trees averaged less than two inches in diameter produced only 2.2 cords per acre of small fire wood, and the cost for the careful experimental operation on the basis of nine man days per acre, was about $30 an acre. This cost could doubtless be much reduced in a commercial thinning operation where the work would not be done so carefully, and where the stand over large areas would be much less dense. It is estimated under such conditions that a man could thin 1 to 1½ acres per day at a cost of $3 to $5 an acre.

The conclusion may be drawn that a stand of red pine 15 to 20 years old with 5,000 or more trees to the acre is in need of thinning and that the growth rate of the remaining trees can be greatly stimulated by a heavy thinning which removes two-thirds of the trees and about one-half of the basal area or volume.

It is interesting to compare the growth of these plots with other data available for the growth of red pine as given in U. S. Department of Agriculture Bulletin 139, "Norway Pine in the Lake States," and as measured in plantations of similar ages in the region. The stands on the thinning plots at 17 years old averaged 10 to 13 feet high which is distinctly less than the figure of 18 feet in 17 years for saplings in northern Minnesota, as given in Bulletin 139 and less than the heights of most of the plantations in the region at corresponding ages. The site on which the thinning plots were established gives no evidence of being inferior to the average for red pine in the region. It may be suggested, therefore, that their comparatively poor mean annual height growth, from 0.6 to 0.8 feet per year as compared with 0.9 to 1.5 in other areas, is primarily due to the stagnating effect of the heavy density of over 5,000 trees to the acre. The only record of red pine of distinctly inferior height growth to that on these thinning plots is in a plantation 16 years old where the trees were left in the transplant rows and had a density of over 15,000 to the acre and a mean annual height growth of only 0.5 feet. In a plantation 20 years old with

2,550 trees per acre, the mean annual height growth was 1.2 feet per year. Plot II in Table 15 of U. S. D. A. Bulletin 139 which had 2,616 trees per acre at 15 years had a mean annual height growth of 1.5 feet. The conclusion is indicated that, up to 20 years old, a density as great as 2,600 trees per acre of red pine does not cause stagnation.

Diameter and volume growth figures also point directly to the conclusion that over 5,000 trees to the acre is too dense for the best development of red pine. The dense thinning plots had average diameters of 1.6 to 1.8 inches at 17 years, whereas records from plantations and natural stands in the region with less than 2,650 trees to the acre at corresponding ages show average diameters of 3 to 5 inches. Similarly, the mean annual volume increment of the unthinned plot with 5,751 trees per acre was only 44 as compared with 59 to 129 cubic feet per acre per annum in plantations with 960 to 2,616 trees per acre on corresponding or inferior sites. Although the figures are not conclusive, it may be pointed out that the growth of the stands with densities of 2,550 and 2,616 trees per acre compares favorably with that of those less dense, and that these densities are not far from the 4x4 spacing which is suggested as the most desirable in planting red pine for high quality by Reed in Harvard Forest Bulletin 9, "Red Pine in Central New England."

Summarizing briefly, the following conclusions have been suggested:

1. Red pine stands, 15 to 20 years old, with over 5,000 trees to the acre need thinning.

2. Thinning from below which removes two-thirds of the trees and one-half of the basal area and volume markedly stimulates diameter and volume growth even in the first two seasons after cutting. Height growth is not increased during this period in the stand as a whole by the thinning, although the codominant and intermediate trees of about average diameter respond more than either the larger or smaller trees.

3. The current annual volume increment per cent was increased from 15 to 23 per cent by the thinning. These percentages corresponded to annual increments of 75 and 115 cubic feet per acre per annum.

4. Densities of over 5,000 trees per acre at 15 to 20 years cause stagnation of growth in diameter, height and volume, which is not evident in stands with 2,600 or less trees per acre.

SOME SLASH DISPOSAL OBSERVATIONS IN THE DOUGLAS FIR BELT

By H. E. Haefner
Cascade National Forest

Slash disposal in the Douglas Fir belt has been given much consideration by foresters and lumbermen for a number of years. It now appears that some fundamental knowledge from all this discussion, experimentation, observation and experience is beginning to crystalize to guide us in the more intelligent handling of the problem.

The Douglas Fir belt covers a wide range of physical conditions that make their presence felt in the nature of the stand, so that it varies from the scattered scrub non-merchantable stand to the merchantable stand of great density and high quality. It is beginning to be felt by many observing foresters and lumbermen that all the slash need not be burned. Due allowance must be made for local influencing factors. What to burn and what to leave is largely dependent on the density of the stand, nature of the ground cover, closeness of utilization and natural fire hazard of the surrounding country. As a general rule, occasional slash areas seem safe to leave when: (1) the debris of logs and broken timber is light or does not exceed 5 or 6 m. b. f. of logs over 6 feet in length and over 6 inches in diameter at the small end, per acre; (2) the brush cover on the logged area is scattering; (3) the slash area is surrounded by green timber or burned-over areas to serve as a fire break; (4) the area is away from railroads, highways and other avenues of human travel; (5) the area can be patrolled during the peak of the fire season if necessary. If most of these factors are not present, sooner or later this slash is likely to get on fire when it will be hard to control. It, therefore, seems very sensible that the slash area be measured, so to speak, to see if most of these safety factors are present. If they are, it means that the selected area appears to have a good chance to be carried through without a fire for a number of years, or until the new crop of trees becomes established, by which time the fire hazard will not be higher than it is on the adjoining burned-over area. On the Western Lumber Company sale two logged areas of about 350 acres each are being left unburned. They are on the opposite side of the river from the logging railroad, and they measure up to these safety standards.

Now, for slash disposal methods. It appears to be comparatively easy to burn slash if it is burned at the right time. There are usually several *right times,* during both the spring and fall of nearly every year. To pick this right time requires experience and observation to discern it when it arrives and then to act promptly. To do this successfully, all necessary details must be attended to before the time arrives. The opportune time may last for several days or it may last less than five or six hours. The man who is responsible for slash disposal needs a good working knowledge of what the weather is likely to do during the slash-burning seasons. This he acquires as best he can through observation and experience. Here is a place where two heads are better than one, especially if the second head is also on the shoulders of a man who has closely observed the changes in the weather and who has burned a lot of slash. The man in charge of slash disposal should also be equipped with a sling psychrometer and a good sized barometer. The latter instrument is invaluable in showing when the probable break in the weather will come. To him, this means rain or very high humidity.

The man in charge of slash disposal wants to time his burning for the rain to strike it just after the peak of the fire is past so that the expensive follow-up is largely eliminated and so that green timber is not menaced. This is not as hard to do as it looks. It is a more or less definite observation by many observers that in the merchantable fir belt proper, there is usually a period or two of very low humidity during the latter part of March or during April, each of which is followed by higher humidity and spring showers, before the regular summer fire season begins. The spring burning should be done at the tail end of these low humidity periods and just when the humidity is rising and the barometer indicates rain. The important point is to get it started soon enough so that the slash is cleaned up by the time the rain begins.

Now, for a few illustrations to show how this theory works in practice. On May 24, 1923, 160 acres were burned near Powers, Oregon, and followed by rain. No follow-up was necessary. On April 10 and 11, 1924, a 400-acre slash was burned near Powers, at the end of a period of very low humidity. The fire burned over this area for two days and had cleaned most of it up by April 12. At 11:00 A. M. on that day, it began to rain gently. On the morning of April 13, the ground was covered with snow and it rained and fogged for over a week thereafter. There was no follow-up and all the fire was extinguished except that in a few old landings which burned until the

next winter. On May 6, 1925, 60 acres were burned on the steep sides of the North Fork Canyon on the Western Lumber Company sale. This fire was set in the morning on a falling barometer and burned fiercely. It began to rain at 5:30 P. M. and rained four inches in the next three weeks. No follow-up was necessary. On September 29 and 30, 200 acres were burned on this sale just before it rained and during the rain, and no follow-up was necessary. In 1926, 60 acres were burned March 21. No follow-up was necessary. In September, four areas, aggregating 200 acres, were burned just before four different showers and no follow-up was necessary.

Since all these areas were burned successfully, many others can be disposed of in the future in the same manner. The cost of all this slash disposal was confined to the wages of a few men to set the fires and there was no loss of logs or equipment.

The loggers' main interest is to get logs at as low a cost as possible. In the past, he has burned some of his slash at little cost, but frequently slash disposal has cost him real money because it was not done at the opportune time. The tendency has been to let slash accumulate and then have it catch fire at a time when control of the fire is difficult. If the logger will watch weather conditions and then, by having all equipment and other property out of the area, be ready to burn, so that he can touch it off on short notice, it is probably safe to say that the bulk of the loss to green timber and logging equipment could be eliminated and the slash menace need not be a cause of so much worry during the summer.

Much has been said against spring burning because of the left-over fires that may go into the main fire season. If the slash is burned prior to May 20 or thereabout, it will have time to burn most of itself out before it will spread in green timber. A few men can be put to work around the edge a day or two after the fire, and extinguish the fire in all stumps and logs from which it might spread into unburned material. It is surprising how much of a slash fire often will go out in a few days. After the fire is absolutely extinguished along the edge, the smoldering logs and stumps need not cause much worry until the main fire season approaches. About June 15 or thereabout, depending on the season, a systematic clean-up should be made to extinguish every last trace of fire before the dangerous season begins. If the spring fires are early, the higher humidity and spring showers will often do this work at no cost, as the foregoing examples have shown. Fall burning, if not done too early, has the advantage that the rainy season is

approaching, which will extinguish the left-over fires. However, there is usually a period of low humidity following the late summer or early fall rains that must be reckoned with.

On the Western Lumber Company sale, the fire is started near the top of the hill or ridge. After it is well started, other parallel rows of fire are started farther down the hill. In this way, the destructive upward sweep of the fire is reduced and there is a minimum of damage to seed trees. A few men supplied with matches and long pitch torches can cover a large slash in a short time. The Hauck torch was formerly used, but it takes two men to lug it around through the slash on a steep slope and then there is often more or less time required to keep it working steadily. Two men with pitch torches and matches can usually accomplish much more.

The slash fire should not be started before late afternoon or evening unless the surrounding territory is safe or unless one is sure that it is about to rain. Fire lines have their place, but often their value is not equal to their cost. The slashings mentioned were burned without fire lines.

THE EARLY HISTORY OF FORESTRY IN CHINA

By Shu-chun Teng, M. F.

From the earliest time to the birth of the Republic the history of forestry in China falls into three distinct periods: (1) The "Ancient" Period, (2) the "Golden" Period, and (3) the "Dark" Period. In very early days the forests in the country were in super-abundance and certain areas of the land had to be cleared for settlement and for agriculture. Under the Chow Dynasty (1122-256 B. C.) there were well-organized offices in the Government giving thought and care to the management of the forests. Then followed a long period when the importance of forests failed to be realized.

In the long history of China, the frequent political changes, military conquests, foreign invasions, and petty insurrections, and the constant demand for wood for the advancement of its civilization, are certainly among the contributing factors to the destruction of the forests. But the preponderant emphasis laid on agriculture throughout almost the entire existence of China as a nation, is of greater significance. With the frequent need for the expansion of the area of land for agriculture, due to the increase of population and to the depletion of agricultural soils as a result of the lack of scientific methods for maintaining soil fertility, forest destruction has been considered as a matter of course; and on account of the absence of proper land classification, unnecessary and wasteful clearing of forests has taken place. But all these factors may be traced directly to the neglect of forestry by the Government.

"ANCIENT" PERIOD

(From the earliest time to about 1100 B. C.)

History suggests that the present Chinese descend from those nomadic tribes who came to the Hwangho region through the Pamir plateau. It was not until the time of Shennung (2737 B. C.) who cleared the land and taught the people the growing of crops, that these roamers began to settle and that agriculture, which has played a very important role in the existence of China as a nation, began to develop.

A great flood occurred in North China during the reign of Yao (2293 B. C.). It is said to have been caused by the overflowing of the Hwangho. It is quite probable that the pasturing of the nomads and the later clearing of land for agriculture along the river caused the destruction of the forests along its banks. This removal of the forest cover on the loess soils of the region might well have led to serious

erosion and the silting up of the river channel, which caused the flood.

In the time of Shun (2255-2208 B. C.) the vegetation was so luxuriant, and birds and animals so abundant that they encroached upon men and made agriculture impossible. Shun therefore appointed Yih to set on fire the forests on the mountains and swamps to drive away the wild animals.

By the time of the Shang Dynasty (1766-1122 B. C.) the destruction of the forests along the Hwangho had been so severe that about 1400 B. C. overflowing of the river again occurred. This led to the moving of the Capitol. Instances of forest exploitation during this period are mentioned here and there in literature.

"GOLDEN" PERIOD

(1100-250 B. C., approximately)

This period coincides approximately with the Chow Dynasty (1122-256 B. C.). Before the rise of the Chow, Tai Wang, a progenitor of the founder of the dynasty, already showed interest in silvicultural practice. He took pains to improve the condition of the forests by building trails, removing the dead, fallen, and defective trees, thinning the dense growths, and eliminating the undesirable species.

History also relates that during the reign of Emperor Chen there took place a big storm when many giant trees were uprooted. After the storm was over, the emperor ordered the people in the country to set upright all the fallen trees.

During this dynasty, there were in the Ministry of Instruction, which had charge of the territory and population, as well as of land classification, distribution and cultivation, commissions of mountain forests and of swamps, and police of foothill forests and of rivers and streams.

The Commission of Mountain Forests controlled the mountains and forests and instituted rules and regulations for protecting them. The cutting of timber was allowed only at certain times; for making farm implements only small timber was used; and theft of timber was subject to punishment.

The Commission of Swamps and Marshes had the control of, and the power to set up prohibitions and regulations governing the swamps and marshes, and the duty of furnishing the Government storehouses with the produce.

Both of these two commissions had charge of matters relating to hunting. They also taught and induced people to raise produce from

the mountains and marshes and propagate birds and animals in jungles and pasture-lands.

The Police of Foothill Forests patrolled the foothills and enforced the regulations for protecting the forests, while the Police of Rivers and Streams had charge of the execution of orders and prohibitions for the guarding of rivers and streams.

In the Ministry of War there was a Guard of Fortresses whose duty was to find out the strategic areas for defense, build roads leading to these areas, and fortify them by opening ditches and planting trees. Political boundaries, likewise, were marked by planting trees.

Among the subordinates of the Minister of Public Works there were carriage-makers, wheelwrights, wagon-makers, carpenters and makers of furniture. All the different kinds of manufacture were standardized, and the taking of different materials from the forests was regulated.

During this period many decrees dealing with the forests were issued. The cutting of timber and the starting of fires in the forests during certain seasons of the year were prohibited. Trees that were not mature enough to be cut might not be marketed. Persons that failed to plant trees were not allowed to have coffins.

Factors which led to forest regulation were undoubtedly the realization of the usefulness of wood and foresight as to the future. Four of the chief raw materials used in construction and manufacture in this period were wood, metal, hides and clay. The use of wood apparently assumed the largest proportion. Besides being employed for building purposes wood was used in the construction of hunting carriages and war chariots. These items probably formed large outlets of timber from the forests.

However, when the Chow Dynasty declined and the feudal states became strong and belligerent, the forestry organizations and practices crumbled. That is the reason why Mencius (372-289 B. C.) who viewed the situation of the country with dissatisfaction, said:

"The trees of the Niu Mountain were once pretty. Being situated, however, in the borders of a large state, they were hewn down. Still, Mother Nature let seedlings and sprouts spring forth, but then came the sheep and cattle and browsed upon them. To these things is owing the bare and stripped appearance of the mountain, which, people think, when they see it, was never wooded. But is this the nature of the mountain?"

On another occasion Mencius said: "If the axes and bills enter the

forests only at the proper time, timber resources will be inexhaustible."

Obviously, toward the end of the Chow Dynasty, the warfare between the feudal states was a very potent factor in the destruction of the forests, and people exploited the forests without regard for the future. Far-sighted men like Mencius foresaw the timber shortage and gave warning as to the need of a conservative policy.

No matter how crude some of the practices in conserving forest resources were in this period, it is remarkable that at so early a time and in spite of their meager knowledge about forests, the Government actually realized the need of forest protection and attempted to carry out a conservative forest policy, without being forced to do so by wood shortage. The most unfortunate thing is that the decline of the power of the Central Government resulted in warfare between the feudal states. This led in turn to the unavoidable destruction of the forests and closed the "Golden" Period of the forest history of China.

"DARK" PERIOD

(About 250 B. C.-1911)

This period in the history of forestry of China occupied a stretch of time of about two thousand years during which many factors worked together to bring about a steady destruction of the forests.

The Chin Dynasty (246-207 B. C.) ushered in this period. Although it is a dynasty of great material development and political expansion, it is one of extreme monarchism and radical change. Its outstanding figure is Chin Shih Huang who built the Great Wall to keep away the northern invaders and who destroyed all the arms in the country to prevent revolution.

Besides the construction of the Great Wall, Chin Shih Huang also built a palace in the Capitol occupying an immense space and with the various parts connected with each other by magnificent colonnades and galleries. Aside from this, numerous villas were built all over the country as the stations for his pleasure tours. At the same time, roads and canals were constructed in all directions throughout the whole country.

It seems quite conceivable that along with all these tremendous construction works, there must have been serious destruction of the forests. In the scarcity of steel and the absence of modern machinery in that time, what engineering task could be done without the use of large stores of timber? We do not know how the Great Wall was erected except that it was built at a vast expense of human labor.

But we have no doubt that the palaces of Chin Shih Huang were built at the expense of centuries of forest growth.

On account of the intense strain and oppression the rulers of the Chin Dynasty imposed upon the people, revolution started in spite of the lack of arms. The people cut down the trees in the forests to make weapons to overthrow the tyrannical government. One of the revolutionists, Hsiang Yu, set the palaces in the Chin Capitol in flame and the fire did not go out for three months. Probably as the Chin Dynasty came and went, a large portion of the forests in China were devastated.

In passing it may be of interest to call attention to the fact that all the palaces of the emperors, the monasteries, temples and other public edifices in China were largely built of wood. This accounts for the absence of the remains of any piece of the ancient Chinese architecture, while the ruins of Egypt, the architectural wonders of the Greeks, and the remains of Pompeii are still preserved as monuments of the past.

Following the Chin Dynasty, about twenty dynasties, of longer or shorter duration, rose and fell. During these times, periods of peace and prosperity alternated with those of agricultural depression and political upset, forming distinct cycles. Many of the short-lived dynasties were completely submerged in the periods of misery.

When a dynasty newly came into existence, there was usually economic prosperity. Gradually the population increased and, at the same time, due to the lack of proper classification of the land and the absence of scientific methods for maintaining fertility, agricultural soils became depleted and many farms were abandoned, so that new farming areas had to be created. The Government usually met the situation by encouraging agriculture and recruiting volunteers to cultivate the "waste lands."

These so-called waste lands might be abandoned farms or areas covered with forests. In short, they were merely uncultivated lands. But if farms are abandoned long enough they may return to the state of nature. Hence the cultivation of the "waste lands" always involved forest destruction; and in cases when the population was shifted from the crowded regions to the sparsely inhabited districts, or when the population was moved to the conquered territories, it undoubtedly caused deforestation of the newly settled areas.

Usually this expansion of the farming area relieved the condition only temporarily. For the destruction of the forests exposed agriculture to damage by erosion and unsteady water supply. Finally, floods and droughts set in, and famine and insurrection were everywhere.

This upset condition was often one of the chief causes of the political overturn and the inability to resist the invasions of the northern tribes, such as the Kins, the Mongols, and the Manchus.

However, as these happened, the population was reduced and the food supply of the country once more became sufficient to maintain peace and contentment. Thus all these factors were linked together, and the process went on in cycles.

Not only is the agricultural expansion a contributing factor to the destruction of the forests. There are others. Military expeditions is certainly an important one. To present a case in evidence: During the Tang Dynasty (618-905), in the expedition to Korea, the progress of the march was hindered by a big swamp of eighty li [1] in width. Immediately 10,000 men were dispatched to cut timber for building a passage across it. Revolutions, likewise, caused periodic destruction of the forests. During the Tsing Dynasty (1644-1911), the Taiping revolutionists, who spread over the country for about a decade, are said to have destroyed forests in sheer wantonness. The fact that the rulers that came from the northern countries advocated pasturing was another factor which tended to check forest reproduction.

As a whole, the process of deforestation in China has been a gradual and steady one, reaching its climax during the reign of Chien Lung of the Tsing Dynasty when the pressure of the growing population was so great that an edict was issued, in 1740, for terracing the mountains for cultivation.

Although efforts in tree-planting were not unheard of during this "Dark" Period, they were rather limited in extent and were largely made from the standpoint of furnishing food for the silkworm and of providing shade. Occasionally, trees were planted for relieving local wood shortage and curiously enough for commemorating military victories. The area planted could hardly have counter-balanced a fraction of the forests destroyed.

North China being the cradle of Chinese civilization and the center of political strife and military maneuvers has naturally suffered the most from the axes and fires of the lumbermen, agriculturists, invaders, and revolutionists. Therefore it has been taken, and no wonder, as one of the most horrid examples of the result of the neglect of forestry.

This "Dark" Period lasted until 1911 when the Monarchy was overthrown and the Republic set up. Although due to political unrest and internal turmoil there has been as yet little development of forestry

[1] One li = ⅓ mile approximately.

under the Republic, the year 1912 marks the beginning of the attempt to carry out a program of modern forestry. It is in that year that the Ministry of Agriculture and Forestry[2] was instituted and the first forest nurseries in the country established.

In 1914 the Forest Law was promulgated, declaring government ownership of forests not definitely owned by individuals or communities, authorizing the purchase of private forests, when necessary, by the Government, and providing encouragement for reforestation and punishment for abuse or maltreatment of the forests. In 1916 a Forest Service was created, with (1) Divisions of Investigation, (2) of Reforestation, (3) of Education, (4) Provincial Division, (5) Propaganda Division, and (6) Clerical Division. Unfortunately the Forest Law was enacted solely under the authority of Yuan Shih-kai, and the Service was entirely under political control. Therefore, upon the death of Yuan Shih-kai and the consequent change in the political regime, the Forest Service was dissolved and the Forest Law ceased to have effect.

An encouraging fact is that, in spite of the ups and downs in the Central Government, some provincial and local governments and certain private individuals and organizations have been steadily carrying on forestry work, chiefly reforestation. Although they have as yet accomplished but little, their activity will increase and their influence spread when the Central Government performs its function.

The victory of the present Nationalist party over the northern militarists will give further assurance for the development of forestry in the near future. The late Sun Yat-sen, the founder of the Nationalist party, pointed out the need of forestry as a part in the solution of the problem of the People's Livelihood and gave forestry a proper place in his proposed program in the building of New China. Therefore, it is confidently to be expected that with the establishment of a stable government with the Nationalist party dominating in influence, the forests of China will be brought under systematic management.

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[2] In 1914 the Ministry of Agriculture and Forestry was combined with the Ministry of Industry and Commerce to form the present Ministry of Agriculture and Commerce with a Department of Agriculture and Forestry attached to it.

RAISING OUR STANDARDS

By Ernest E. Hubert
Professor of Forest Products, School of Forestry, University of Idaho

There is a good old Western saying that bristles with the crude candor of frontier days. This expression, "Put your cards on the table," to me, expresses the spirit the professional foresters have shown in their frank criticism of forest education. Such a presentation of the weaknesses in our forest educational work is both startling and encouraging. Startling because it suddenly brings before us important matters that need serious and immediate attention, and encouraging because wholesome, constructive criticism is always an excellent incentive to improvement.

Some of these criticisms may appear to some to be rather overdone or one-sided but out of such a mass of divergent opinions as to what is wrong with forest education and with the forestry profession in general, there should crystalize a few fundamental truths which will guide us in the right direction.

In reading the editorials and the various articles in the March issue of the Journal of Forestry I am impressed with the one idea that runs as a thread throughout the discussions on forestry, the forestry profession and forest education. "Raising the Standards" seems to be our battle cry and it strikes me as one that is both timely and worthy. Raising the standards of our profession by prescribing more careful and prolonged training both in the forest schools and "on the job" can not fail to build for the future. To this end the machinery for an impartial rating of forest schools should not be delayed in installing. Encouraging greater scientific activity and raising the standard of our research work both in and out of the forest schools will no doubt prove stimulating to those who are engaged in investigative work. But beyond all these improvements, the profession as a whole needs a spiritual revolution. Much has been written in this Journal about the need for greater vision for "Where there is no vision, the people perish." This vision must concern itself not only with the ethics and the trend of the profession but must also look sharply to its scientific strength, to the development of its Fifth Estate.

I sometimes wonder if our so-called professional weakness as foresters is something fundamental, something that springs from our mental attitude towards our life work. We are too prone to visualize a

forester as one who lives among lumber-jacks and pick-up fire fighters, who knows how to fight fire, repair a telephone line, scale logs and who can bunk with comfort in the dirtiest of camps. Briefly, a hard-boiled woodsman! Without question, a forester should be a good woodsman for that experience is an essential part of his equipment. But to be "tough" does not always mean that he should be able to "lick his weight in wild cats" or that he should be able to sleep on a sackful of porcupines and awaken complaining of a soft bed. This general attitude is often reflected in forest schools where the tendency is to emphasize the so-called more practical subjects and neglect the fundamental sciences. This may not be a conscious attitude and I believe it is being rapidly changed, for after all, forestry practice involves an unusual number of the sciences. The steel industry rests upon such fundamentals as physics and chemistry, dealing with but one major element, iron. Forestry involves in addition to physics and chemistry, such sciences as botany with all its divisions, zoology, geology, meteorology, entomology, pathology, and several others dealing with a complexity of both organic and inorganic substances. If our forest education is to be sound and is to endure, it must be built upon fundamentals; forestry fundamentals to be sure, but without neglect of the sciences that are basic to these fundamentals.

One must often meet the criticism of a forestry student who complains in these words: "Why make us learn all these technical details, they have no application to *practical* forestry?" This shows a strong tendency on the part of the student toward a vocational rather than a professional viewpoint of his life work. Such an attitude must be corrected and the student should be instilled with the importance, idealism, and high standing of his profession, without letting him swing too far through the arc of adjustment and leaving him with the thought that a "white collar" job is the first thing to look for. Forbes[1] struck home when he stated that we must get into the habit of thinking of ourselves professionally, as scientists. For after all, though it may sound paradoxical, the high rating of a profession is measured by its scientific depth.

The criticism, sometimes made by professional men in the older sciences and professions, that forestry is more a gospel than a science may have been true in the days when forestry in this country was young and had to conquer its own frontiers. The older sciences raised in the nursery beds of Europe were brought to this country as healthy trans-

[1] Forbes, R. D., The Next Generation, Journal of Forestry, 25: 260-280, March, 1927.

plants at a time when American forestry had not yet reached the stage of the imprisoned seed!

Encouraging a greater production of high class research work that, when published, will command respect will fully answer the criticisms of the older sciences. Forestry is young, but in this age when progress is so rapid, must forestry drag through the same number of slow years in preliminary development that has characterized the development of the older sciences and professions? Can she not profit by the accumulated knowledge and experience of others and, setting a high standard, reach the elevated position to which she is entitled? Now that forest conservation has become an accepted part of our national life, it is no longer necessary to sacrifice so much of our time to the selling of forestry. More time can well be given to searching out the fundamental truths that will serve to solve the problems confronting us. The splendid development of our federal forest experiment stations is a witness to this fact.

A few valiant men with the courage of conviction sold forestry to the nation. During this early struggle to win the outposts of opposition over to the idea of conservation, little time and money could be spent on planning and carrying out long continued, painstaking experiments. But now, out of the smoke of the forest fires, appears scientific curiosity to determine the how and the why and the when of devastating fires. And out of the vast cut-over and frequently burned-over areas, rises a new spirit of investigation, to inquire how these areas may be returned to a profitable production of timber. Before the advancing menace of a tree disease that is as deadly as fire but slower and less spectacular, there arises a determination to discover the most practical method of protecting our remaining white pines or of re-establishing the doomed chestnut. In the wake of a sagging lumber market and facing the onrush of substitute products there arise federal, private and academic organizations engaged in solving the numerous problems of wood utilization and in reclaiming waste. New pulping woods are tested. A steam exploded pulp process is discovered. Short and odd length lumber is finding markets. And a growing tendency to conserve our green timber by making our wood products last longer is manifest. These are merely the signposts beside the rapidly broadening highway along which we are traveling. But they are significant signposts and they point beyond the smoke and the snags and the stumps to an inspiring future.

The spirit of research in forestry is just awakening and the gradual lifting of standards toward a higher level of excellence is but one of the signs that indicate a healthy upward trend.

WHY NOT TEACH APPLIED FORESTRY

By E. A. Sterling
James D. Lacey & Co.

Because of business connections not based entirely on academic forestry, it is perhaps not in order for me to comment on the interesting discussion of Forest School education in the March issue of the Quarterly. It is my well founded belief, however, that one of the next and most needed phases of forestry in America is a closer linking with business, which means with private owners and consumers of forest products whose capital is involved, if forestry is to be practiced on the 75 per cent, or whatever it is, of private forest lands.

This in no way reduces the importance of the technical side. In fact, professional knowledge is fundamental if forestry as an art and science is to be properly applied. The bridge engineer must know the principles of design and the stresses of the material used to a technical degree unknown to the average forester, but being a member of an old accepted profession, he can be purely technical and design only what the business man has determined shall be built. He is a more valuable engineer, however, if he can make a commercial analysis of the need for and the returns from the structure he builds.

The forester, on the other hand, if he applies his profession outside of federal or state forests, must sell the idea to the man who has capital invested. This is the penalty of representing a relatively new profession, in which the foresters themselves disagree as to the place and conditions, if any, where it will pay to grow trees rather than "mine" them.

As employers of a considerable number of Forest School men, we have found that their value is primarily as men and not as foresters. Their training gives them some foundation and they are encouraged to complete their school work on the chance it may help them later. On the other hand, some of the best men connected with actual forest operations are not educated as foresters, yet do real forestry work.

Eliminating the unfit, what is it the better class of Forest School graduates lack? They can not be expected to have experience, they can not possibly have first hand knowledge of forest regions and conditions, and they have no basis for applying their new found knowledge to practical problems—many men never seem to learn the latter. Age

and experience are the crucibles in which youth is tempered and which colleges can not supply.

What then is the trouble? The answer as we have seen it is in the superficial training—a dab of this and that; the lack of objective which leaves the boys with little real conception of what it is all about; and the wrong conception that forestry is the end and not the means to the end—which means growing timber to fill a universal need and at a profit. There is, perhaps, a fourth factor in the men who take up forestry without being fitted for the rather strenuous and exact requirements if they are to be successful.

Forestry to succeed must pay. To succeed, it must be well founded, hence the need of pure science in its development. It is in the application that most of the fault lies, and this strikes home to the old timers rather than to the youngsters who are the hope of the future. Give them the viewpoint of growing trees to produce wood and earn dollars, and the next twenty-five years will tell a different story. Use the research data we have before making a fetish of getting more and ease off on preaching the same old gospel among ourselves. Give the younger generation the inspiration to go out and spread this viewpoint and the sensible training to apply it, then Dr. Schrenk's arguments—at present largely true—will fall.

The older foresters console themselves that the unfavorable pioneer conditions prevented practicing their profession, and it is a good alibi. We should not, however, get so crabbed and stiff jointed that the real chances now developing can not be seen and capitalized. Doctor Fernow used to tell us we would never be able to use the forest technique he was giving us, nor did he know where we were going to get forestry jobs when we finished school.

Most of us have jobs of a sort and today in our own strictly commercial field, we are practicing on limited areas, the kind of forestry which has called for a deliberate cash investment in forest land for the purpose of continuous timber production at a profit. Perhaps this is not forestry, but it is heading that way and when a boy fresh out of Forest School is set to burning fire lines as part of a working plan, he begins to get the practical features of the problem.

Shepard says "Wanted: Dirt Foresters," while Coolidge asks "Who really wants them?" Every timberland owner does to the extent they can increase both present and future yield in dollars and wood from forest land. He does not need foresters whose main conception of their job is to make pretty maps, grow nursery seedlings, and draw a

meager salary. Even Chapman, who read some of us out of the profession a few years ago because we were tainted by association with the lumber industry, says in the sales leaflet for his book "Forest Finance": "Private land owners must be sold on forestry as a practical business before the profession can feel satisfied that the economic needs of the country will be fully met."

No specific blame is attached. The trouble is that the faculties of the Forest Schools never had to make a row of dollars earn 6 per cent when invested in private timberlands, nor can they possibly have first hand knowledge of the diversified conditions governing the many private holdings. That is not their fault either—just the inevitable limitations in training and experience. They can not fully appreciate the facts governing the conduct of forestry as a business, unless in intimate long time contact with the problems involved in the management of timberlands and the trusteeship of capital. The theories and textbook principles may be ably polished and handed down, but the facts which would help make forestry a more virile and essential part of present day industrial life are not fully driven home to the students, because the teachers can not give what they do not have. If forestry in America is to live and be worth while, it must be an applied science and Forest School education should be directed to this end.

THE SOCIETY OF SWEDISH FORESTERS

(Svenska Skogsvardsföreningen)

By James L. Averell

While tom-toms beat in the Society of American Foresters' circles with regard to a permanent secretary for the organization, perhaps it would be of interest to learn the solution another country has found for this problem. Choose a country whose greatest natural resource is its forests, a country whose forests during 1924 produced $170,200,000 worth of products, yet one whose forests are operated on a sustained yield basis. As such a country one could choose Sweden. Have the Swedish foresters a permanent secretary for their society? Yes, but—.

Svenska Skogsvårdföreningen is the most comparable Swedish organization to the American society. It was organized in 1902 for the purpose of promoting better forest management in Sweden, chiefly through arranging meetings, discussions and excursions and also issuing publications. Its membership, which now numbers 4,260 (192 of which live in countries other than Sweden), is open to all those who are interested in forestry. Since the entire population of Sweden is less than that of New York City, this membership number represents a good percentage.

The Swedes have not felt that they need a professional society in the strict sense of the word. They have an association for the older technically trained foresters, one for the younger, one for the sawmill men, for the river-drivers, for the lumber exporters and many others, but they all meet together on common ground as members of Skogsvårdsföreningen.

This society employs a permanent secretary for an amount equal in purchasing power to $3,000 a year in the U. S., who is a technically trained forester, capable (speaks three languages fluently) and understands the society work thoroughly. He is the active editor of the monthly technical forestry journal "Skogsvårdföreningens Tidskrift" and the bimonthly popular forestry magazine "Skogen." The publications of the Royal Forest Experiment Station, which correspond to U. S. D. A. bulletins, are published as supplements to the society's Tidskrift. Since the editing and expense of the supplements are cared for by the government, little or no worry is caused the society through them.

During 1926, the technical Tidskrift was printed in editions of 1,700 copies. The yearly volume totaled 408 pages with 136 illustra-

tions (plus 386 pages of administrative notices), exclusive of the experiment station supplements. Skogen came out in editions of 5,800 copies. The yearly volume consisted of 344 pages of text, 170 illustrations and 304 pages of advertisements. The technical articles in the Tidskrift are practically always accompanied by a resumé in English, French or German.

The secretary and staff of four persons occupy the association's office, an attractive four-room suite centrally located in Stockholm. One of the assistants is a technically trained forester and works only on the popular magazine "Skogen." A woman clerk handles the stenography and the dues. The third is a man clerk, writing the advertisements in Skogen and helping with the proof reading. The fourth is a mailing-boy.

One of the society's events each year is an excursion. Last year a two-week study trip was made to Germany. This year they plan to go to north central Sweden to visit the forests of a large pulpwood and lumber company, as well as the Royal Forest Experiment Station's research area at Kullbäcksliden. Such trips are always well attended and full of interest. Another event arranged each year by the secretary, is the society's annual meeting, held just previous to Swedish "Forest Week." The secretary also takes an active part in any other forestry meeting which may occur, helps the foresters from foreign lands in studying Swedish practices, furthers the aims of the society as to a rational forestry policy, and encourages the growth in membership. Furthermore, he writes each year to the large and rather wealthy associations dependent on forest products, such as the Cellulose Assoc., and the Lumber Exporters' Assoc. and convinces them that it is to their interest to help the Society of Swedish Foresters financially. The government is also asked each year for a contribution, as well as the Government Forest Service. During 1926, these donations were approximately as follows:

Swedish Forest Service	$2,500
Swedish Government—direct subsidy	3,500
Swedish Lumber Exporters' Assoc.	800
Swedish Cellulose Assoc.	700
Swedish Wood Pulp Assoc.	200
Swedish Paper Mfgs. Assoc.	200
Swedish Forest Owners' Assoc.	400
Total	$8,300

The income of the society, other than these subsidies and the dues of the members, comes from the advertisements in the popular forestry magazine. An advertising man puts in all his time in securing ads and is paid 20 per cent of the money he brings in. This work is of course aided by the secretary of the society.

The dues for membership, including subscription to the popular magazine "Skogen," is $1.90 per year. There are 4,260 such members. By paying a total of $5.40 per year, one receives the technical journal of the society in addition, including the reports of the forest experiment station. There are 1,133 (of the 4,260) such subscribers. Life membership, including all three publications, is arranged for by paying the surprisingly low figure of $27.

The printing cost of the two journals and the experiment station supplement is about $12,600, plus $506 for illustrations. The society is reimbursed for the printing of the supplement. The authors do not have to pay for illustrations to their articles, but instead are often paid a small fee for their paper. This is especially true of the articles in the popular magazine, many of which are written at request of the secretary. During 1926, $1,729 were paid out to the authors of articles.

This description of Skogsvårdsföreningen is offered, not with the thought that such a plan would exactly fit American conditions, but rather in the hope that it may prove interesting to see what another country is doing and perhaps be the source of some new ideas for improving the Society of American Foresters.

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Compiled by Helen E. Stockbridge, Librarian, U. S. Forest Service

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Minnesota Glacial Soil Studies: II. The Forest Floor on the Late Wisconsin Drift; III. Density of the Surface Foot in Forest and Prairie on the Late Wisconsin Drift, by Frederick J. Alway and Paul M. Harmer. Soil Science, Vol. XXIII, No. 1, January, 1927, 57-70; 73-80. 1 Pl., 3 Figs.

Foresters will be interested in these two contributions from the Division of Soils of the University of Minnesota in which some of the properties, considered significant by soil scientists, in the forest floor and the underlying mineral soil, have been carefully determined and presented with a welcome description of the forest conditions where the samples were collected. Nine samples were taken of the forest floor and of the underlying 6 inches of mineral soil of virgin forest areas within the limits of Late Wisconsin calcareous glacial drift: 3 from spruce-balsam-birch forest near Mizpah, 3 from maple-basswood type near Hamel, and 3 from a transition type between maple-basswood and oak-maple near Taylors Falls.

Determinations were made of the oven-dry weight per unit area, the color, acidity, volatile matter, moisture equivalent, nitrogen, phosphoric acid, organic carbon, and ratio of organic carbon to nitrogen. The amount of forest floor per acre varied from 13 to 28 tons in the hardwoods and from 23 to 97 tons in the softwoods. All of the samples showed little or no acidity. Nitrogen ranged from 444 to 878 pounds per acre in the hardwoods and from 722 to 2,847 pounds in the spruce-balsam-birch. The figures for nitrogen when expressed as the percentage of the total nitrogen in both forest floor and underlying 6 inches of soil are 16 to 26 per cent and 54 to 77 per cent respectively. The authors therefore point out that a fire which consumed the forest floor in the southern forest would liberate about 1/5 of the nitrogen and in the northern, more than 1/2, making the loss far more serious in the latter case. The phosphoric acid content was about 0.3 per cent on all three areas, but it amounted to only 1/16 of the total in the hardwoods and 1/4 in the softwoods. In this case the effect of burning would be to make proportionate amounts of the phosphoric acid available which in the northern forest region might distinctly benefit crops on soils deficient in phosphates.

The moisture equivalents averaged 110 for the forest floor and from 13.8 to 26.0 for the mineral soils. From these figures the interesting deduction is suggested that the dry forest floor may absorb from 0.10 inch at Hamel to 0.93 inch of rainfall at Mizpah, before any of the moisture would reach the mineral soil.

Comparisons are made with similar figures from 3 samples from balsam forest near Duluth, cut-over white pine forest at Blackhoof, and jack and red pine forest near Nickerson. The forest floor had properties quite similar to those already given, but the mineral soil of the sandy jack and red pine area was strikingly lower in moisture equivalent, nitrogen and organic carbon.

The second article by Dr. Harmer contains the results of determinations of the densities of the soils *in situ* in the four 3-inch sections of the surface foot of 12 virgin areas, 6 from Hamel and Taylors Falls as above, and 6 from the prairie. The densities in pounds per cubic foot, moisture equivalents, and nitrogen contents are given for each 3-inch layer. In the surface section, the densities were quite similar in forest and prairie, but below 3 inches they increased gradually in the prairie and rapidly in the forest, until the forest soils had densities 1/3 higher in the 7-12 inch sections.

J. K.

Taxation as Applied to Forest Properties and Cut-over Land. By George Banzhaf, Marquette Law Review. Vol. 10, pp. 84-88.

The primary purpose of this article is to call the attention of the readers of this magazine to the fact that there is a forest and cut-over land tax problem in Wisconsin and to the attempts made in other states, particularly Michigan and Lousiana, to solve this problem. The difficulties of the owner of forest or cut-over lands under the present tax system are touched upon. These difficulties tend strongly to unnecessarily hurry the marketing of the present stand of timber, thereby intensifying the future shortage of timber.

J. H. Allison.

The Economic and Social Importance of Animals in Forestry, with Special Reference to Wild Life. By Dr. Charles C. Adams, Director, Roosevelt Wild Life Forest Experiment Station, Syracuse, N. Y. Roosevelt Wild Life Bulletin, Vol. 3, No. 4, pp. 509-676, Oct., 1926. 30 Illustrations, 14 Tables, 19 pp. Bibliography.

Fifteen years ago forestry was a method of averting a timber famine.

Today forestry is becoming a guiding idea in the use of land for promoting human welfare.

Growing population and rising standards of living are forcing on us the conviction that each piece of land should serve more than one purpose. Forestry happened to be able to show that each piece of land can serve more than one purpose. Hence the expansion in its social as distinguished from its merely economic significance.

Premised upon these facts, this bulletin assembles under one cover the accumulated evidence to prove that in forests we can raise animals as well as trees, if only we will set about it intelligently. It strongly suggests the need of a similar treatise assembling the accumulated evidence that on farms we can raise game as well as crops. In fact the bulletin surveys the possibilities of public lands and waters as well as forests, and to this extent covers the second as well as the first field.

Foresters who intend to read this bulletin (and every forester should) will do well to begin with the last chapter on "The Need of Leadership" and "The Development of Policies." It contains much that is good for what ails us in our primary function as managers of timber, as well as in our secondary function as managers of game and recreational use. As to leadership: "There is needed a willingness to draw conclusions . . . in advance of their popular recognition," an admonition which the first generation of foresters did not need, but which we today perhaps do. As to research: "Investigators are . . . the catalyzers or hasteners of progressive changes, and in forestry there is no exception." As to education: "We frequently hear from executives the great need for others of their own kind, and at the same time investigators see an equal need in their own line. . . . It is the main function of the executive and the investigator to resolve these limiting factors by cooperative effort. . . . The next logical step seems to be for the colleges of forestry . . . to train men . . . in general forestry, *economics,* and *sociology,* combined with special detailed knowledge of the ecology of fish, game, fur, and the domestic animals of the forest." (The italics are mine.)

To the forester interested in the technology of game management the most interesting part of the whole bulletin is the chapter on productivity of lands and waters. Here are assembled with painstaking thoroughness and gratifying brevity the available figures on what an acre of pond, lake, or forest supports in game breeding stock or produces in game crops. Just as the assemblage of data on forest stocks and yields was the first step toward the visualization of the normal forest, so is this assemblage the first step toward the visualization of normal stocks and yields of wild life. The figures are alarmingly poor and few as measured against the need, and gratifyingly abundant and concise as measured against all previous similar attempts at compilation. Only those who have tried to state the elements of game management in quantitative terms can realize either the paucity of or the need for reliable figures.

This bulletin covers a field of such size that no attempt at summarization in logical sequence is possible. Here and there it seems dry, but this is not surprising in view of the many ramifications of the subject. Most of it is as vital as the reader's receptivity, which is as much as can be said of any book.

A. L.

The Economic Development of the Furniture Industry of the South and Its Future Dependence Upon Forestry. By C. F. Korstian. Economic Paper No. 57, Department of Conservation and Development, State of North Carolina. Raleigh, N. C., 1926. Pp. 26. Illustrations 4. Bibliography.

Wood-using industries naturally have their beginnings and become centered at points close to sources of their raw material. Of this tendency to centralize in certain localities Mr. Korstian says, however, that "At present the most potent factors appear to be labor and markets, rather than raw materials." Notwithstanding the importance of labor supply, one finds existing furniture-producing centers to be close to the original sources of supply, or if a center has developed in a large general industrial region like Chicago, or New York, it is largely because raw material is obtained from every direction of which that locality is the hub. When the tributary forests become depleted and the easy flow of the raw material to the factories becomes dislocated, the industries become embarrassed and may do one of three things—die off, move nearer new raw material supplies, or import raw materials from a distant region at added expense. Whichever course wins, the industries lose and the local communities dependent upon them share their embarrassment. Any plan which seems in a fair way to assure a steady and perpetual flow of raw materials to the established industries is deserving of close study, but a survey of the facts must always precede its preparation.

In Mr. Korstian's paper he limits his subject to the furniture industry of the South, but in this case the South is principally North Carolina, this state producing 60 per cent of the furniture shipped from the region, the remainder coming from Tennessee, Virginia, Georgia, and Alabama. It will be new knowledge to many to learn that North Carolina is an important furniture manufacturing state. The value of its furniture production in 1923 was over $40,000,000, and this high figure was reached in only nine years from a value of less than $10,000,000 in 1914.

The author, following a brief introduction, covers the history of the development of the furniture industry of the South. The first

factory in North Carolina was built at High Point in 1888 and today that city is the "Grand Rapids" of the South. Discussing raw material supplies, the author gives statistics which show how heavily the Southern hardwood forests are being drawn upon. Only 12 million acres remain of the original 60 million acres of old growth hardwoods, and these 12 are scattered over 35 million acres of commercial forest. "If present conditions continue the Southern Appalachians will have ceased to function as an important source of high-grade hardwood lumber . . . within 15 years . . ." The lower Mississippi Valley hardwood stands still contain nearly 133 billion board feet, or more than twice as much as the virgin hardwood remaining in the Southern Appalachians. The author confuses his readers a little by bringing softwoods into the discussion. Considering prices, the author states, "Hardwood lumber prices have followed a much sharper and more consistent increase than those of softwood lumber. The leveling effect of inter-regional competition is less apparent, due in part to the more general distribution of hardwood forests and the relatively smaller consumption of hardwood lumber." The average cost of lumber per thousand feet at the North Carolina furniture factories was $18.05 in 1909 and $59.20 in 1919. The reviewer believes this an unsatisfactory comparison, however, because the year 1919 was abnormal and 1909 itself unsettled.

Diminution of supplies in the North Carolina furniture industry is already being felt; oak and yellow poplar have fallen off, while the use of gum, imported chiefly from the Mississippi Valley, has increased from one per cent in 1909 to 21 per cent in 1919. North Carolina is already in the stage where it must import lumber to maintain its industries. Based at first upon a local demand for cheap furniture the industry now produces furniture of all grades; 15 per cent is classed as cheap, 70 per cent as medium priced, and 15 per cent as fine grade. Walnut and mahogany are now used with local woods and veneered products are common. This is an indication that the character and skill of labor have improved and that high cost of materials and manufacture has driven the manufacturers to higher grades of products. It indicates also that the future of the Southern furniture industry is all the more precarious. When local supplies are too far gone, it is doubtful in the reviewer's opinion if the industry can survive. If the High Point, N. C., region, for example, must depend for its raw material supplies upon distant regions it loses its advantage over larger manufacturing and more urban centers closer to markets. The state of North Carolina should therefore be anxious for the future of its

furniture industries and for the prosperity of the towns depending upon them, and it should take steps seriously and without delay to put its cut-over lands at work producing raw materials in perpetuity.

Discussing the problem of future supplies to keep the Southern furniture factories in raw material the author calls attention to the inroads of substitute materials; the savings possible through the production of "small dimension" stock at the saw mill, and the growing of timber crops as the ultimate solution. ". . . the desired results can not be attained if timber production is left entirely to the initiative of the private owner of forest land or is attempted through compulsory regulation of privately-owned timberlands. The responsibility rests squarely upon the public and the owner of forest land . . ."

April 11, 1927. E. F.

The Financial Return from the Cultivation of Scots and Corsican Pines. By W. E. Hiley. Oxford Forestry Memoirs, Oxford University Press, American Branch, New York; No. 6, 1926. Pp. 32.

This carefully prepared analysis of the economic factors in the planting and cultivation of two important European pines is more interesting to American foresters in viewpoint and method of attack than in the actual figures of costs and returns which are not directly applicable to conditions in the United States. The memoir deals with the usual economic factors considered in planting, namely, the investments and annual expenses, the returns in wood product and in value, and the profitableness of the operations on different sites.

The interesting points in the method of attack include first, the treatment of the factors which are variable and regarding which it is difficult to generalize, such as the cost of land, cost of planting, annual expense, rate of growth, and future timber prices, as admittedly variable factors in the calculations and therefore expressing them for the ranges of variations in each, which are most likely to be met with in actual practice. These ranges of probable values based on the best existing information and reasonable predictions, are used as the basis of tables in which the profits are expressed as the mean annual forest per cent.

In the prognostication of future timber prices, which is always one of the most difficult factors to evaluate, Mr. Hiley starts with the present stumpage prices for the two species in the English markets. He then finds that the price of timber in comparison with the British Board of Trade wholesale index number, which in itself expresses fluctuations due to the changes in the value of money, has increased at the rate of about 0.9 per cent per annum. He considers that this

rate of increase is likely to continue and to be in about the center of the range of probability for this factor. On this basis, calculations are made for three alternatives; (1) that prices may remain constant, (2) that they may rise one per cent per annum, and (3) that they may rise 1½ per cent per annum. The ranges of the other factors are more easily set on the basis of existing information.

Tables are given showing the rate of interest return for the combinations of probable values for each of the factors. From them it is possible to make comparisons of the profitableness of growing Scots pine or Corsican pine, of growing either one or the other on different qualities of site, of the costs which may be incurred for land and planting when a certain rate of return is desired, and of the different probable future values of the products when the qualities of the wood are considered.

Finally, the tables are used as a basis for indicating how much may be spent in the improvement of the land by cultivation, drainage, fertilization, or better methods of planting in order to improve the site quality and consequently the growth of the timber. It is further suggested that it might be possible and desirable to spend still greater amounts in the improvement of the land so as to make the site suitable for the growth of a more valuable species than either Scots or Corsican pines, and if this could be done the greater value of the better timber would pay for a very considerable investment in land improvement.

It is pointed out that a continuous and uniform rise in the price of timber does not lengthen the financial rotation. Under the most favorable combination of circumstances, Scots pine can be expected to yield not over five per cent compound interest on the investment on site quality I, and only just over four per cent on site quality II.

Similar methods of analysis based on the best existing information in the United States would be valuable in formulating wise reforestation operations and programs.

J. K.

Bibliography of the Woods of the World (Exclusive of the Temperate Region of North America) **With Emphasis on Tropical Woods.** Prepared by the Tropical Plant Research Foundation for the Main Research Committee of the American Society of Mechanical Engineers. Tropical Plant Research Foundation, Washington, D. C. November, 1926. Pp. 121, titles 1,341, index 7 pp.

This bibliography is in mimeographic form and was prepared "as a first step towards a study of tropical woods which may be found useful for American wood working requirements in the place of native

species of which the quantity or quality is deteriorating." (The quotation is from the letter of transmittal). The distributors are desirous of obtaining from all interested in tropical woods such comments, corrections and additions as will make a proposed 1927 edition more useful and more nearly complete. The reviewer considers this a most worth while and timely undertaking and urges those who have a list of literature on tropical woods to offer its use to the compilers.

It is a revision and extension by Major George P. Ahern and Miss Helen K. Newton of a bibliography compiled in 1923 and 1924 by Professor Samuel J. Record, Yale Forest School. To the latter for his large interest in tropical woods and his prodigious effort in ferretting out the data for the first bibliographies, the wood-using world will be lastingly in debt.

There are 1,341 titles, and the index is prepared in a detailed and useful manner. Most of the titles are followed by a key letter referring to one of six libraries; the reviewer is unable, however, to discern whether this refers to a library supplying the title, or one possessing the book or paper. The work is divided into five parts and an index. The first is "General" and contains 176 titles, many of which are of works of general value in wood technology and apparently may not refer to specific tropical woods. The other parts cover Tropical America, Europe, Asia and Oceania, and Africa.

As indicated above, many of the titles cover books and papers bearing upon wood technology only in its most general sense, and many titles are of botanical interest only. This is not criticized, but if this bibliography is to contain some general works on wood technology and some works on the botany of certain individual or groups of tropical trees it should include as many as can be discovered and then the title should be changed enough to make it include the trees and not only their wood. For example, the reviewer was unable to find F. Roth's Forest Service Bulletin No. 10—old but classic and still extremely useful; also, being familiar with the work of E. D. Merrill on Philippine trees, he was unable to find a single one of his many writings listed in the Philippine department. Nor was he able to find in the general part of the quarterly "Tropical Woods." While they are at it the compilers might as well carry out such a suggestion and make the bibliography most complete. In fact the technology of woods should not be separated from the botany (and silvics if known) of the trees producing them—a deplorable failing of botanists in general. The reviewer suggests also that the bibliographies in such works on trees and woods

that might contain them be gone over carefully that no title be missed. This should be a fruitful source of material.

An interesting thing about this compliation is the fact that it was published from an appropriation made for this specific purpose by the American Society of Mechanical Engineers. The engineers evidently haven't much faith in the efforts of foresters to bring about the realization of continuous crops of hardwoods on present hardwood lands. The engineers are taking no chances and are already taking a first step to obtain hardwood supplies from the tropics. Incidentally the action of the A. S. M. E. is something for our own Society to ponder over.

April, 1927. E. F.

NOTES

Fire to Fight Fire

In view of the recurrent discussion as to the value of "light burning" as a preventive of more destructive fires, particularly in pineries, the following notes on a practice which seems to be developing favor in India, may be of interest. They are taken *verbatim* from the "Report on Resin Industry and Report on Forest Administration in the Kumaun Circle, 1925-26," and have been sent to the Editor by Mr. Canning of the Indian Forest Service.

CONTROLLED BURNING
ON AN EXPERIMENTAL BASIS

Controlled burning made great progress during the year and the work in fact passed out of the experimental stage though more experience has still to be gained as to the degree of immunity obtained from these operations in an unfavorable season and as to its cumulative effect on the forest.

A conference was held of all Divisional Forest Officers and many Rangers at Ranikhet early in the season. Practical tests of controlled burning were carried out, rangers and other subordinates were trained and the best methods discussed and the technique of the operations standardized. This enabled the work to be then taken up vigorously in all divisions.

The following statement shows the work done in resin tapping areas:—

Division	Area Burnt Under Control, Acres	Average Cost per acre[1]	Average Cost of One Unit of Labor Employed
		Rs. a. p.	Rs. a. p.
West Almora	12,939	0 1 4	0 5 0
Naini Tal	3,521	0 5 11	0 8 7

The number of channels that caught fire in these operations was very small indeed and the result of the burning was to make the areas practically safe from any fire damage until the next fall of needles late in the hot weather. Even then it is reported that with the year's fall of needles only on the ground a fire occurring in an area previously burnt under control, could be easily checked and put out and did com-

[1] A rupee is worth about 32.4 cents of American money and an anna 1/16—about 2 cents.

paratively little damage. The season, as already noted was, however, a particularly favorable one in the early part of the hot weather of 1926 though abnormally hot and dry in June. It requires experience of one of the periodical very dry early hot seasons before a final decision can be given regarding the full success of early controlled burning. For the present prospects of success appear excellent.

The experimental observation was continued in the West Almora division of the progress of resin production over 2,675 acres containing 47,348 channels which were burnt in the 1921 fires with the following results:—

Year	Outturn in Maunds per acre	Outturn in Maunds per 100 Channels
1920-21	.90	4.01
1921-22	.12	.61
1922-23	.31	3.01
1923-24	.77	3.08
1924-25	.82	4.40
1925-26	.96	4.65

The results of 1920-21 show what was obtained before the fires. The area was burnt in 1921-22 but has since been safely protected from fire.

The above figures show that the surviving trees have recovered, a conclusion which is supported by the progressive improvement in the crop of the whole circle in recent years. The improvement in outturn per acre is, however, small and indicates the large number of trees killed by the fires.

ON A PRACTICAL BASIS

In all some 41,837 acres were burnt at an average cost of two annas per acre.

A conference was held by the Conservator in November, 1925, at Ranikhet at which all Divisional Forest Officers were present and numerous range officers and forest subordinates from the nearer charges. Three days were spent in demonstrational and practice burning, at which the Deputy Commissioner of Almora also very kindly attended, and in the evening discussions were held at which proposals for future work and the details of the technique were decided.

After this all Divisional Forest Officers started the work in their own divisions generally first having divisional concentrations to teach their own staff.

The work roughly consists in burning a forest downhill at a season when the fire will not become intensive. The period within which this can be done varies with the locality and with the nature of the season. In some places burning can commence soon after the rains and in places it can be carried out even as late as May; generally from November to March is the most favorable period. A ground fire is laid along a contour and is either allowed to extend down hill if it will progress thus by itself or is extended down hill by further lines of fire at short distances five to twenty feet down hill (firing depth). The important things are that the front of the fire is maintained always burning in a horizontal line and that the firing depth, when successive lines are laid, is so small that an intense heat can not be generated even if the short intervening space burns uphill.

The confines of the strip to be burnt are adjusted to the topography of the locality, advantage being taken of all such natural boundaries as ridges and damp nalas. In the most careful burning of young regeneration areas a width of only three or four chains is burnt; in more open areas such as many of our resin tapping forests strips of 100 yards and more can be successfully burnt.

The stage at which regeneration areas can first be burnt depends on the amount of inflammable debris, the height and quantity of the grass and undergrowth and the height of the regeneration. In grazed areas with comparatively little grass regeneration two feet high can be safely burnt. Where the grass is heavy regeneration requires probably to be four times the height of the grass before burning can be satisfactorily done. Debris from fellings requires to be burnt as soon after the fellings as it will burn, as nothing gives so much trouble and does so much harm in controlled burning of regeneration areas as a lot of scattered slash. The ground round the base of seed bearers should be cleared in advance of the burning whenever possible as this enables the labor to give more attention to protection of the seedlings during the actual burning. Patches of immature seedlings can often be saved by burning round and excluding them.

Areas under resin tapping can safely be burnt, the ground round the bases of the trees being cleared in advance to a width increasing according to the slope of the hill side. Normally a width of about 3 feet suffices.

Areas neither under regeneration nor resin tapping can be burnt with even greater ease but in both these last cases, even where regen-

eration is not aimed at, much protection can be given during the burning to patches of seedlings of two feet height and above.

The department aimed primarily at burning under control regeneration and resin tapping areas but publicly notified villagers that if the burning of other areas was desired, villagers would be allowed to do this up to May 15, under the supervision of forest guards.

The following statement shows the area and average cost in each division of controlled burning:—

Division	Regeneration Areas		Resin Tapping Areas		Other Areas	
	Acres	Cost per acre	Acres	Cost per acre	Acres	Cost per acre
		A. p.		A. p.		
Naini Tal.....	3,191	5 3	3,521	5 11	7,070	Nil.
Garhwal.....	1,136	10 5	.....	.....	1,728	Nil.
West Almora.....	6,284	1 8	12,939	1 4	3,340	Nil.
East Almora.....	2,628	0 6	.....	.....	.....	.....
Total.....	13,239	3 0	16,460	2 4	12,138	.....

The rates paid for labor vary somewhat in the divisions, but the most important factor governing the cost of this work was the extent to which the villagers gave full help. It was found that when the local range officers were in touch with the people and explained the idea to them, the villagers came forward readily and gave one day's help free for any class of burning.

The extent of protection in a bad hot weather in the event of subsequent fires resulting from controlled burning and the frequency with which the burning should be repeated are matters to be decided after further experience. The hot weather season of 1926 following this controlled burning was unusually rainy and cool until late in May and hence facilitated protection. June however was an abnormally dry month and the indications of results in this month are that controlled burning does much to obviate the likelihood of dangerous late fires in an area and to make such as may occur easier to control.

The statistics in the forms are given for the year from April 1, 1925, to March 31, 1926, and therefore concern in the main the fire season of 1925. Rains broke very early in June, 1925, and the season was thus a very favorable one.

The areas included in the forms have undergone a thorough overhauling and include now only old reserves and of class II new reserves

only regeneration and resin tapping areas, plantations and fuel and fodder reserves.

The area in which protection was attempted was accordingly 272,328 acres (425 square miles) as compared with 310,522 acres (485 square miles) shown last year. The area in which protection was successful was 98.6 per cent as compared with 93.7 per cent last year.

The cost of protection was Rs. 16,328 as compared with Rs. 19,684 last year. The introduction of controlled burning has therefore been accompanied by a reduction in the expenditure on protection.

At the June meeting of the Kumaun Forest Committee the members were given details of the year's results of controlled burning and noted the very satisfactory progress made and recorded their appreciation of the good work of the forest officers of the Kumaun circle in obtaining such progress in the first year and of the good sense and public spirit of all those people of Kumaun who gave their help freely in this work.

This recognition is much valued by the Kumaun forest officers, who also cordially thank the members of the committee and the people of Kumaun for their help and co-operation in the work.

F. Canning.

Spontaneous Combustion as Cause of Forest Fires

On October 6, 1922, in Monroe township, Clarion county, an instance of spontaneous combustion occurred. The district forester's office was notified of a fire which when reached by suppression forces was found to be a very small area, 1/100 of an acre and in the middle, still smouldering, was an old barrel full of empty cloth salt sacks, which had been dumped there several days before. The site was fully exposed to the heat of the noon day sun and was such that it was partly under observation of a residence several hundred feet away. The people at this place saw the smoke issuing from the barrel before the flames burst forth. No one was seen near the barrel at the time the smoke was first discovered.

Chas. E. Zerby.

Mont Alto's New Science Hall

The Mont Alto State Forest School in Pennsylvania, one of the early pioneers among forest schools, has added a fine new building to its equipment. Science Hall was dedicated on March 10. Addresses were made by several leaders in forestry and education, including Mr.

C. E. Dorworth, the new secretary of the Department of Forests and Waters.

The new Science Hall is a three-story building, 155 feet long and 75 feet wide. It contains seven lecture rooms, five laboratories, a library, large museum room, and auditorium with a seating capacity of 300. The building is built of brick and harmonizes with the other school buildings. With this new building, educational facilities for 100 students will be available.

Mr. Dorworth, who is the executive head of the state forest service, spoke of the progress Pennsylvania has made along forestry lines in the past 50 years. Forest protection has made great strides. In 1913 less than half the forest fires in the state were reported. Now more than 98 per cent are promptly reported to forest officers. However, the 1926 record of 2,917 forest fires, burning 224,256 acres, causing damage amounting to $1,186,326 and costing $177,353 to put out, shows there is much ground yet to be gained. Mr. Dorworth points out strikingly that the fires did a daily average damage of $3,250.

Extension of the state forest holdings is one of the foremost things Mr. Dorworth is urging. The present state-owned forest area of 1,132,444 acres should be expanded to include a much larger share of the total of 13 million acres of forest land in the state. Mr. Dorworth quoted the governor as strongly favoring his proposal for a land purchase appropriation of $500,000 for the biennium.

Practical object lessons in forestry on the state areas throughout the state should be rapidly developed, in Mr. Dorworth's opinion. They should likewise be extended to the private lands. Quoting Mr. Dorworth's closing paragraphs:

"The forest problems will not be on the road to practical solution until there are available in all parts of the state demonstration plots that show in a most practical and helpful way all the essential forest practices necessary to a proper handling of the forests of the state. We can not afford to stop short of this goal in our educational program in forestry.

"Forestry in Pennsylvania will go forward with a sound, business-like program of forest development. We will not permit it to slow up. The work of the Department of Forests and Waters will be waged aggressively and progressively during my administration. Pennsylvania's proud record of achievement in forestry will not only be maintained, but further extended. There are many brands of forestry. The

brand that I am devoted to takes forestry into the woods and brings the greatest benefits to the greatest number of people."

International Forest Bibliography

Professor Badoux, director of the Swiss Forest Experiment Station, who presided over the meeting of the International Commission on Forest Bibliography at Zürich on April 23 and 24, 1926, has submitted the following corrections in the reports of the Committee on International Relations in Forestry and of the Forestry Classification Committee as printed in the February, 1927, issue of the Journal of Forestry:

1. Professor Hesselman was not appointed as chairman of the reorganized and enlarged bibliographic commission. He was proposed for the place but declined. Professor Oppermann therefore continues as chairman. Professor Hesselman did, however, accept the chairmanship of the International Union of Forest Experiment Stations, the next meeting of which will be held in Sweden in 1929.

2. Of the two proposed schemes of classification submitted by Dr. Flury and Professor Oppermann and considered at the Zürich meeting, only one—that by Dr. Flury—was in printed form.

3. The two classification schemes submitted by Dr. Flury and Dr. Oppermann had many points in common. After considerable discussion, agreement was reached at the Zürich meeting on the main outlines of a classification embodying certain features of both. This proposed classification was printed with accompanying explanatory text under date of April 24, 1926, in English, French, and German, and has since been widely distributed.

The Committee on International Relations in Forestry desires to take this opportunity to express its thanks to Professor Badoux for his interest in correcting the record on these points. It understands that the proposed bibliography will be one of the major subjects for discussion at the meeting of the International Union of Forest Experiment Stations in Sweden in 1929.

S. T. Dana, *Chairman,*
Committee on International Relations in Forestry.

Charles Lathrop Pack Celebrates His Seventieth Birthday

On May 7, Mr. Charles Lathrop Pack celebrated his 70th birthday, and in order to commemorate the event and his 50 years of service to American forestry, a Birthday Book containing 116 letters was presented to him by a delegation of foresters, at Lakewood, N. J.

A handsome leather bound volume enclosing these letters was inscribed as follows: *To Charles Lathrop Pack From His Forestry Friends and His Friends of Forestry.*

Among the letters sent to him were some very warm tributes from such men as President Calvin Coolidge, Secretary of Agriculture W. M. Jardine, President Hibben of Princeton, President Farrand of Cornell, Chancellor Flint of Syracuse, President Little of Michigan, Governor Gifford Pinchot, Col. Henry S. Graves, Col. Wm. B. Greeley, Mr. John Hays Hammond, Mr. Owen D. Young, Col. Theodore Roosevelt, former President, Henry S. Drinker of Lehigh University, President Garfield of Williams College, Mr. William Allen White, the heads of most of the American Forest Schools, practically every State Forester and nearly every forester of large prominence in federal, state and private organizations.

Among the letters received from abroad, were those from Director General Carrier of the French Forestry Service, Director General Stella, and Chief Inspector General Alberto Cotta of the Italian Forest Service, Lord Lovat, Lord Clinton, Col. Sutherland, Mr. R. L. Robinson and others of the British Forestry Commission, Professor R. S. Troup of Oxford, England, and many others distinguished in European forestry.

Mr. Pack received a great number of congratulatory letters and telegrams on May 7, in addition to this bound volume of letters. There were some exceedingly warm tributes to his wide variety of service to the cause of American forestry, not only in educational work but in the promulgation of research programs, in the establishment of demonstration forests, his service in advancing the work of tropical forestry, his many contributions of American tree seeds to Europe, and the several books which he has been author of or sponsored, through the American Tree Association.

Forest Fire-Weather Research

Paul W. Stickel
Assistant Silviculturist, Northeastern Forest Experiment Station

In the April, 1927 issue of the Journal, Mr. Burrill in his article on "Weather and Fires from the Standpoint of Meteorologist" states: "Studies carried on by the Northeastern Forest Experiment Station indicate that a tenth of an inch of rain suffices to keep the moisture content of the duff above 25 per cent for a period of three to four days, and that the danger-free period is longer when the humidity is high than when it is low." This statement applies to the mixed softwood-

hardwood of the western Adirondack Mountains, which is doubtless what Mr. Burrill had in mind. It does not, however, hold true for forest conditions in the entire Northeast.

Relatively small amounts of precipitation are more effective in keeping the duff above the inflammability point where it is of the matted type produced by the admixture of hardwood leaves, than where it is composed entirely of coniferous leaves. Most strikingly is this true in the white pine type, where relatively large amounts of precipitation when immediately followed by dry, hot weather accompanied by high winds are of practically no use in keeping the duff above the danger zone. Two examples taken from the records of the forest fire-weather station in a clear cutting in the white pine type at the Harvard Forest, Petersham, Mass., will illustrate this point. On June 3rd, 1926, at 8 A. M. .14 inches of rain was recorded; yet, at 2 P. M. the same day the duff moisture had dropped to 12 per cent. On June 25th a total of 1.07 inches of rain fell. During the following night it rained again, a total of .17 inches of precipitation being recorded at 8 A. M. on the 26th. At 2 P. M. the same day, the duff contained only 8.8 per cent of moisture. Such examples are by no means uncommon especially during the late spring, summer, and early fall. Besides the low humidities, high winds, and high air and duff temperatures, there are other factors which contribute to this extremely rapid drying out of the duff. Chief among these is the porous character of the pine duff, which allows the rapid percolation of the water. Likewise, the type itself plays an important part in determining how great is the influence of various amounts of precipitation. The stations at the Harvard Forest are on gravelly soil of a climax white pine type of the poorest quality, where the surface water runoff is at the maximum.

It appears evident that with the many diverse forest types and forest regions which are found in the Northeast, no general statement as to the relationship between precipitation and freedom from forest fire danger can be made. Each principal region must be considered individually not only from the viewpoint of meteorological conditions, but likewise from the viewpoint of the role played by the character of the duff, the general soil conditions, and the natural inflammability of the particular duff in question.

What Is Wrong With Our Forest Education?

305 Hilgard Hall, May 10, 1927.

Editor: I enjoyed reading your editorial on "Our Forest Schools" and Forbes' article "The Next Generation" in the March JOURNAL, because, first of all, you are both so frank and courageous as to write what you feel without pussyfooting, and second, because what you say will make all of us take stock of ourselves. You'll get a lot of replies, no doubt, from teachers; some will be violent protests, others will be alibis. My reply is principally a protest, but I shall point out a real defect, if it is one, both of you apparently overlooked.

I disagree with you both on most points. You have covered a little too much territory and are too sweeping in your criticisms. Some changes have taken place at certain schools of which Forbes in particular is not aware. There is indeed a screw loose, and a few missing, in our teaching of forestry, but the faults you point out are not peculiar to forestry, they are faults of teaching in general. This, of course, does not condone our own faults nor give us a reason for delaying their correction.

You seem to feel that a teacher of forestry should have a Ph.D. degree. Such a degree is a nice thing to possess, but for the kind of forestry we can practice the three years required to attain the Ph.D. might be spent to better advantage by the prospective teacher in obtaining practical experience. For certain courses, however, advanced college study and a Ph.D. should be a desirable item of equipment. Engineering teachers are seldom equipped with the Ph.D. If they spent the three years following their undergraduate days in practical work they are much better equipped to teach than those who put three years in the narrow slot of the Ph.D. machine.

The time is *not* passing when all graduates in forestry find jobs awaiting them. Operating lumber companies would absorb many more than they take now if the men were differently trained. We are teaching too much of forestry and too little of subjects fundamental to it, as well as too little of subjects outside of forestry that are badly needed by all college graduates who expect to be useful. In some forestry courses material is dealt out to undergraduates which the teacher did not learn until he himself was a candidate for an advanced degree. Present them with an elephant and they'll feel less at a loss to know what to do with him than they will with the weighty forestry they have to study.

Older foresters are likely under the impression that the forestry

schools still receive men of the crusader type as was the case in the first decade of forest school existence. Our freshmen now are of the same type that enter the other professional schools. They have the spirit of service of the earlier classes but I believe they are much more practical minded. Unless we make a special effort to obtain them and have a sales talk that we can back up with jobs having a future, we should not expect to obtain a better average of students than that which enters the other professional schools. Engineering, law, medicine, architecture, etc. are just as fascinating to some prospective students as forestry is to others. Incidentally, those members of the Society who are guilty of it should cease featuring to boys who come to them for advice the imaginary low pay and rough life of the forester. Very few engineer graduates receive such good pay, and have such a pleasant apprenticeship as do the forestry novices.

Yes, we teachers have made and are still making many mistakes but they are as nothing compared to the blunders of the employers of our graduates. Perhaps I have been too fortunate throughout my life in always having had nearly ideal bosses; anyway, I believe I know what a good boss can do for an inexperienced man feeling his way. It was one of my duties at the University of California to place graduates; observation of their progress leads me to say that many of them have not been given a fair deal by their bosses. Whatever good the teacher might have accomplished is vitiated by the boss that follows him.

I hope that neither you nor Forbes expect the teacher of forestry to be both a great teacher and an outstanding research man. The two don't necessarily go together and mighty few men have been such super-beings. I count myself fortunate in having had a splendid lot of really great teachers in the engineering schools I attended. They were, above all, thorough in the fields they taught and exceptionally inspiring, yet very few of them could qualify as research men although practically each one was constantly exploring fields beyond his own experience, if only to keep himself up-to-date. If a teacher does no more research than that he has done well. I know several teachers who are stars as research men but rotten as teachers. What makes one good, makes the other bad, and vice versa. After all, a teacher is a peddler of information, ideas, and inspiration. A University should seek first of all to train men. If it emphasizes research on the part of its teachers as being paramount to teaching, it ceases to be a school but becomes a research institute. The two can go together very well if properly bal-

anced, but in a school, teaching and its improvement must come first.

The one big thing in which the schools have fallen down is in their appreciation of what present-day American forestry demands. It is the fault of the whole forestry profession rather than of the schools. It is just about time that we stopped, in and out of the schools, painting a black future for the United States if we don't practice forestry, and that we buckle down to find out just how much of the forestry we have been dreaming about can actually be applied at the present time on private lands—particularly those of the West. It may be considered treason to say so, but I have wondered the past three years if the type of man needed by private operators should not be an engineer with an understanding of forestry rather than a forester overloaded with advanced mensuration, silviculture, and management, but very deficient in engineering. If I'm right, we are certainly not training our students properly for private employ. I am emphasizing private employ because it is on private lands where forestry is lagging. We have learned a lot of high-pressure forestry that does not seem to fit this—the biggest problem we have. Forestry I am sure would be farther advanced on private lands if, from the start, we had tried running alongside the car until we equalled its speed before boarding it, instead of trying to knock it off the track. Some of our schools still see nothing but federal forestry, when, as a matter of fact, the same effort should be directed to training men specifically for private employ.

We do need some men trained in the fields now emphasized in forest schools but not such a heavy percentage. I believe we should have annually twice as many or more graduates than we now have but that 60 per cent should be equipped with a foundation or background of engineering rather than one based on the biological sciences. Forestry is after all very largely a matter of engineering—especially as to its practicality—and a man trained primarily as an engineer, and therefore equipped with realism, will make, in my opinion, more headway toward attaining our goal of perpetual yields than will his biology-trained colleague. I do not mean by this that the former can get along without the help of the latter; what I mean is that we need both types, but many more of the former. I wonder if it would not be desirable for forestry schools to make alliances with the engineering schools of their respective universities. In this way it would become possible for a student with an aptitude for engineering and a penchant for the lumber industry to obtain the usually excellent fundamental engineering training and viewpoint of the engineering department and concurrently

take the usual courses in lumbering, wood technology, and mensuration of the forestry department plus enough general forestry to teach him what forestry "is all about" and how logging ties in with silviculture. A student with such inclination would have to major in engineering and minor in forestry instead of vice versa. I believe such a man would be less likely to start out with a lumber concern in a daze than the one loaded with subjects for which there is no immediate need. Whatever his training, each young man entering private employ eventually has an opportunity to become an executive. The path to such a goal will be easier for the engineer-forester. All along the line of his development he will have had ample opportunties, if he is the right sort and has been correctly inspired, to work forestry in wherever it is possible. I believe he should make an ideal executive and that he would accomplish most for forestry. If you have time let me know what you think of my plan.

Being on sabbatical leave this year makes it impossible to keep in close touch with my colleagues, so the views expressed above are my own.

Yours for better and more adequately trained foresters.

EMANUEL FRITZ
University of California.

May 11, 1927.

Editor:

I wish to congratulate you on the recent issue of the JOURNAL. Both of us apparently believe that there has been too much "parrot learning" in our schools and that the student is not entirely at fault I believe that Professor Kraus is correct when he states that too many professors like to hear their "golden words" handed back to them in the same fashion that they were passed off of the "silver platter." It seems obvious that encyclopedic knowledge will not meet our educational situation as we want to meet it in forestry.

I was very glad to read the comments relative to the Ph.D. degree and I believe that the facts were well expressed. The Ph.D. should signify a sincere and genuine interest in the subject. As soon as the diploma becomes a ticket to an "easy" job, the subject matter is bound to become more or less shallow and superficial. I hope that forestry will not suffer any such boomerangs on this score as have been experienced in other professions.

DOW V. BAXTER.
Assistant Professor

Varietal Differences

At the Fremont field station of the R. M. E. S., on the slopes of Pikes Peak, is a plantation of western yellow pine set out in 1916, at the age of about three years. This plantation, which includes representatives from 10 localities covering the region from the Black Hills of South Dakota to southern Colorado (about four degrees of latitude), averages only two to three feet in height and is just beginning to show variations which may be due to the varied sources of the seed with respect both to geography and individual parentage.

On April 29, 1927, it was noted that one block of these trees, whose source had been the Black Hills, presented a very bare appearance. Close examination showed that practically every needle of the 1926 crop, and some of those of greater age, had been cropped off close to the base. Two trees in one corner of the plot had escaped serious injury. Yellow pines of San Isabel origin on one side and of Leadville origin on the other, had escaped this injury except that a few trees had been "sampled" enough to satisfy the depredators that their *taste* was different. Although definite signs were lacking, the presence of many deer in this vicinity, and the nature of the cropping, point to these animals as the fastidious selectors.

In other words, here is a case of animals, who depend on a highly-refined sense of smell and taste, "selecting" a geographic strain from among closely-related forms of the same species, when there are no exterior differences which could be considered of practical importance. This selection by a browsing animal suggests differences in taste of the different pines and hence differences in chemical composition. Because the Black Hills pine has been more subjected to winter-killing than any of the others, and hence may be assumed to be more resistant to drying while in the dormant state, our imagination pictures a qualitative or quantitative difference in cell-sap which may give rise to winter hardiness. Without going into details, it is our impression that such differences have already been demonstrated for apple twigs. That, however, is not the main import of this note, which is to emphasize the fact that in such a widely-distributed species as western yellow pine varietal or geographic strains exist which are extremely difficult to recognize by any superficial criteria, under ordinary circumstances, but which, within a few years after planting are likely to prove of the greatest practical importance.

C. G. Bates.

Excursions of Foreign Forestry Associations

The Swedish Forest Conservation Association (Svenska Skogsvårdsföreningen) will hold a joint excursion with the Forest Conservation Union of Norrland (Norrlands Skogsvårdsförbund) from June 19-21, 1927 at Vindeln in Northern Sweden where an inspection of the Kulbäckslidens research forest will be made under the leadership of Prof. Henrik Hesselman. The forest holdings of the Robertfors Co., will also be visited. Owing to the courtesy of the latter the expenses will amount to but 75 Swedish crowns. Registration should be sent to the secretary A. Holmgren Vasagatan 23-25, Stockholm. Number limited to 100.

The German Forestry Society (Deutsche Forstverein) will hold a summer meeting and excursion from Aug. 21-27, 1927 at Frankfurt-am-Main.

The program includes the following:

"Cooperation between Science and Practice in forest Research."
(Led by Prof Hausrath and Landforstmeister Dr. Weber.)

"White pine (*P. strobus*) as a forest tree."
(Dr. Wappes, Prof. Wanselow and Freiherr von Tubeuf).

"Forest types."
(Forstmeister Dr. Rubner).

Excursions will be made to the Frankfurt Communal forest, Taunus, Spessart, Schwarzwald and other places. Expenses are estimated at 15 marks per day, and registrations should be sent to ministerialdirektor, Dr. Wappes, Franz Josephstrasse 30, Munich, Germany.

H. I. Baldwin.

Memorial to C. R. Pettis

In order suitably to mark the grave of Clifford R. Pettis, near Paul Smith's in the Adirondacks, the undersigned have been appointed as a special committee of the New York Section, Society of American Foresters.

Mr. Pettis' contributions to forestry in this state make it fitting that his grave should be marked in some manner to differentiate it from the ordinary family burial plot. As a tribute to the man and to his work, the funds for this purpose should be secured from the many persons throughout the state who were associated with him during his lifetime and who are interested in the same problems that he was. No

large contributions are desired, rather the hope is to let as many as possible of Pettis' friends have a part in this memorial.

If 400 people contribute $5.00 each, or 2,000 people $1.00 each, a sufficient sum of money should be secured.

Several years ago Pettis suggested that he would like his grave marked with an Adirondack boulder. It is the intention to carry out his wish and to place a small bronze tablet upon the boulder selected. The grave will receive perpetual care and, on Arbor Day each year flowers will be placed thereon.

Contributions for this purpose may be sent to the Chairman, Arthur S. Hopkins, 23 South Pearl Street, Albany, N. Y., or to any member of the committee, before July 1.

Very sincerely yours,

A. S. Hopkins. *Chairman.*
Nelson C. Brown
Ralph S. Hosmer
Barrington Moore
A. B. Recknagel

SOCIETY AFFAIRS

Ohio Valley Section Plans for Meeting

In order to give all of the members and visiting foresters plenty of time to make their plans, announcement has been issued for the fall meeting of the Ohio Valley Section of the Society.

A feature of the meeting will be an itinerary covering a number of interesting plantations and forestry enterprises. Members of the section will meet Thursday night, October 7th, at Cambridge City, 10 miles west of Richmond. Friday they will go South to see Roth's planting of three acres of walnut 25 years old; Lizzie Myers' virgin forest of 120 acres, including beautiful tulip, white oak and black hickory. One tulip tree was sold from this tract last year for $100; Lewis' tract of 80 acres of pin oak, cow oak, sweet gum and other species forming the best second growth in Indiana; Denny Farm, including five acres of natural reproduction of sweet gum and red maple type on east side of woods; see Guthrie's woodlot improvement project, with forest clearing reinforced by 10,000 planted trees.

Friday night the meeting will be held at Clifty Inn. All discussions are confined to 15 minutes by the leader and five minutes by others. Four subjects will be covered at each meeting, each one to be discussed by five men from five different states.

Saturday will be spent at the State Forest, examining white and Scotch pine, which averaged 24 inches height growth annually. Time will also be given to hardwood planting failures, replanted to conifers, and an examination of nursery developments. The party will return to Clifty for the final discussions and papers, the subjects include For-Forest Education and Forest Publicity. Arrangements are in the hands estry Nursery, Control of Forest Diseases and Insects, Marketing Forest Products, Afforestation, the Woodlot, Taxation of Wood Lands, of Burr N. Prentice, Secretary, Purdue University, Lafayette, Ind.

Annual Meeting of the New York Section

Substantial action toward adequately financing the Society and employing a trained executive, marked the annual meeting of the New York Section, held in the Regent's Room of the State Education Building at Albany, on February 2, 1927.

The Section expressed itself almost unanimously as in favor of the increase in dues, and voted that for the next three years the dues for senior members of the Section should be $10 per year, and for members $5. Any surplus of this amount over what is needed for the

regular conduct of the Section's affairs, will be turned over to the treasurer of the Society, as substantial evidence of the Section's recognition of the importance of the Society's work.

The meeting, with four dissenting votes, took a stand against the policy of soliciting funds outside the membership of the Society.

Sadness was cast over the session by the untimely death of Clifford R. Pettis, who passed away suddenly on January 29, and for a few moments the members stood in silent tribute to the man who had for so long been one of the leaders of the Section, and a great force in New York forestry.

Chairman O. M. Porter was authorized to communicate with Conservation Commissioner McDonald, advocating the establishment of demonstration forests outside the State Forest Preserves, the advantages of which were discussed at the meeting.

The Committees on Legislation and Forest Policy were combined on motion of Major Barrington Moore, and brief reports were made by Professor S. N. Spring, for the Program Committee, and by A. B. Recknagel, for the Section's Committee on Standards.

President R. Y. Stuart spoke at some length on the development of the Society, and the Section's obligation to it.

The program of papers included:

Girdling of Hardwoods to Release Young Conifers—H. L. Churchill.

Pulpwood Measurement—D. A. Crocker.

Results of Recent Studies in the Consumption of Forest Products in New York State—R. C. Hoyle.

Work of New York Wood Utilization Committee—A. B. Recknagel.

Electrical Resistance of Wood to Determine Moisture Content—L. W. Rees.

The entire program was characterized by vigorous and frank discussion.

The meeting closed with a dinner at Keeler's, at which Herbert A. Smith, Editor of the Forest Service, spoke briefly on the responsibility of forestry, and S. T. Dana recounted the story of the International Forestry Congress at Rome.

A resolution was adopted, calling upon the Committee on Policy and Legislation, to examine critically the propaganda of the Association for the Protection of the Adirondacks, recommending regulatory control of logging on private lands in the Adirondacks, and the recom-

mendation of Governor Smith to a similar effect, and to report its findings to the Section at the August meeting.

The invitation of Professor Nelson C. Brown was accepted for the summer meeting of the Society, at the time of the dedication of the State Ranger School at Wanakena.

Twenty-seven members and 15 visiting members attended the sessions. Officers for the year include Chairman O. M. Porter, Secretary J. N. Spaeth, Executive Committee—H. L. Churchill, W. G. Howard, F. F. Moon, E. C. M. Richards.

Appalachian Section Adopts Five-Year Program

Approval of a five-year program of work, marked the Sixth Annual Meeting of the Appalachian Section, held on January 16th at the Bent Creek Field Laboratory of the Appalachian Forest Experiment Station. The projects chosen include the following:

1. Indexing the Proceedings of the Society, the Forestry Quarterly, and the Journal of Forestry. This is to be undertaken by the entire Section, under the leadership of a committee headed by E. F. Korstian. Investigation will be made of work done by others in this line.

2. Continuation of the Work of the Committee on Forestry Education in secondary schools and those up to collegiate grade.

3. Encouraging preparation of papers on "Valuation of Forest Lands for the Production of Timber Crops."

4. Stock-taking Survey of Appalachian Region, through a new Committee (to include A. C. Shaw).

5. Continuation of Study of Private Forestry Practice, by strengthened committee under leadership of Verne Rhoades.

Chairman E. F. McCarthy reported that eight men had been elected to Society membership during 1926, and the Section unanimously endorsed the nominations for membership of six new men and one application for senior membership. Authority was granted the Executive Committee to send out new member nominations at any time and to call for letter ballot.

After lunch at Bent Creek, which was served by the ladies, McCarthy, Sims and others gave a demonstration of archery, the ancient art of foresters.

The Section adopted a strong resolution favoring the increase in dues when a new and more moderate proposal is submitted.

In the evening a dinner was held at the Battery Park Hotel in Asheville, at which Paul G. Redington told of the annual meeting of

the Society at Philadelphia, and Mr. Rue described the development of a new pulping process at the Forest Products Laboratory. Healthy discussion added interest to all the sessions.

Society Represented at Pan-Pacific Conference

C. S. Judd and T. C. Zschokke represented the Society of American Foresters at the Pan-Pacific Conference, held in Honolulu April 11-16, 1927. Report of the forestry discussions will appear later.

Society Members Meet at Southern Forestry Congress

Twenty-five members of the Society, representing seven Sections, met for dinner at the Lumbermen's Club at Jacksonville, Florida, on the evening of March 23, the second day of the Ninth Southern Forestry Congress. President Stuart spoke briefly on the responsibilities of the Sections to the Society as a whole, and members from various parts of the South discussed the future of the Society. It is hoped that meetings of this character can be held at all of the larger conferences, from time to time throughout the country.

North Pacific Section Considers Live Questions

Discussion of private forestry practice occupied the center of the stage at the January 28th meeting of the North Pacific Section, held in Portland. Thirty-five members and visitors were present.

Chairman C. S. Chapman introduced Captain John B. Woods, Forester of the Long-Bell Lumber Company, who gave his answer to the question "What is Private Forestry in the Pacific Northwest?" Captain Woods' paper was printed in the February 1927 issue of the Timbermen, and will appear in a later number of the Journal of Forestry. Captain Woods reviewed the experience of his company in different parts of the United States, pointed out the necessity to justify the necessary investment in protection and reforestation of cut-over land, and sounded a note of encouragement in the value of well stocked land, as a salable property. Small second growth in the South, he said, had quadrupled in value during the past five years.

Private forestry in the Pacific Northwest, he declared, has the advantage of starting while virgin forests remain, and at a time when the development of forestry can better be forecast, than ever before. Operators can profit also, he said, by the technical experience of foresters who have been struggling with the problem for years.

Captain Woods stated his conception of forestry as going back all the way to the lands, and defined it as "a sustained effort to utilize completely the timber producing capacity of land."

Meeting for the first time outside of Portland, in the rooms of the Tacoma Chamber of Commerce, on February 16, 1927, the North Pacific Section tackled the subject "How to Make the Public Forest-minded," E. T. Allen leading the discussion.

Mr. Allen, with experience which perhaps no other man has had, reviewed the progress of securing public support for forestry, emphasized the advances of the past few years, but declared that even greater future effort was needed. Mr. Allen stated that he believed law enforcement was important enough to warrant the employment of a special constabulary in all states, to police camping places and to enforce general observance of forest fire laws. He also ventured that operators could be convinced of the wisdom of brush disposal, leaving seed trees and similar matters, in the same way that they have been won over to fire protection.

Sharp discussion followed Mr. Allen's address. John D. Guthrie spoke of the need for getting news before the public, and suggested local Chambers of Commerce as a suitable medium. Burt Kirkland thought that not more than 50 per cent of forest land in the Northwest would mature a crop under present practices of fire protection, and declared that the situation needed much improvement. State Forester George C. Joy agreed to this need, but pointed out that many areas never burn over after the first disposal of slash.

Dean Hugo Winkenwerder spoke on the need for taxation legislation in Washington, reaffirming his belief in the theory of a nominal annual land tax, and a yield tax on the crop when removed, as a means of keeping cut-over lands on the tax rolls. He paid tribute to Senator J. W. Shaw, who has been a champion of progressive forest legislation in the Washington State Senate, and who, in addressing the Section meeting, declares that more education was needed to bring about concerted action in the Legislature. The State as well as private owners, he said, would have to go into the business of growing trees.

Dean Winkenwerder also paid tribute to Representative Clarence W. Saunders, Chairman of the Washington House Committee on Forestry and Logged-off Lands, who declared that the interest of the general public was the principal one involved in the perpetuation of the State's greatest industry, and that no stone should be left unturned to insure reforestation.

Thirty-two members attended the session and the chairman pointed out that this section perhaps covered the widest territory, and actually

had the largest membership of any section of the Society, drawing as it does, from Alaska, British Columbia, Oregon, Washington and Hawaii. T. T. Munger, Director of the Pacific Northwest Forest Experiment Station, who had been designated to lead the discussion, made the following points:

"What is practice of forestry?

"In Oregon there are many other things that a timberman can do in the way of practicing forestry besides planting young trees.

"The protection of stump land against fire may appear on the surface to be forestry, but it is not necessarily forestry.

"A purchase of second growth timber, as a speculative venture, may appear to be forestry, but this is not necessarily true forestry.

"The practice of forestry is largely a matter of psychology. An operator must think of the matter as a continuous crop.

"Even sustained production may not necessarily mean the practice of forestry.

"The motive of the operator must be analyzed before it can be known whether he is practicing forestry or not."

Mr. Munger's comments started a very lively argument as to the advisability, or practicability, of classification of forestry practice upon a man's declared intention, or upon his actual procedure and actions.

Mr. E. T. Allen stated that it was all right for the large operators who owned wide acres of reserve timber and sufficient money to hire foresters, to make a big noise in the press and in other ways about their declared intention to practice forestry, but the little fellow, or the operator who is about cut out can not do this. Nevertheless the little fellow who is keeping out fires and letting the little trees grow, is practicing forestry just as much as the fellow who tells the world about it.

Mr. Allen defined the practice of forestry as "keeping the land productive—keeping the little trees growing—one year or for any period."

Mr. C. M. Granger stated that he had been giving this subject much thought. He said that we would be going far afield if we try to classify the matter according to declared intention rather than actual practice. The two can not be separated. The selection of a measuring stick to use in determining whether forestry is being practiced is a difficult one. This measuring stick should be a list of practices which the operator should be expected to follow. We should set up a pretty high standard to be considered from a long range viewpoint.

Mr. Granger said that the proposed survey of private forestry or a definition of the practice of private forestry, if one is decided upon, is not a movement to cast credit or discredit upon the owner of the land.

Others who contributed to the discussion were Osborne, Langille, Gibbons, Jacobson, Chapman, Collins and Ramsdell.

The March 25 meeting of the Section was addressed by L. F. Cronemiller, Assistant State Forester of Oregon on "Slash Disposal in Selective Cedar Operations" and by George C. Joy, State Supervisor of Forestry for Washington on "Improving Our Slash Disposal Practice." Both papers are timely contributions and will be briefed for an early issue of THE JOURNAL.

A Plan for Employing a Paid Executive

March 11, 1927.

Mr. S. B. Detwiler,
Bureau of Plant Industry,
Washington, D. C.
Dear Detwiler:

Our discussion of the ability of the Society to employ an executive secretary or manager resolves itself to the proposition of whether the members desire to enlarge the scope and influence of the Society. On this point there is a diversity of opinion, and it is difficult to outline the duties of a manager until these conflicting views are compromised to something approaching a common desire.

Since its inception the Society has been a common forum mainly for technical discussions, and its outstanding achievement has been the publication of a technical journal. Its influence *per se* on legislation has not been great. Few if any of the 1,300 members hold their present positions by virtue of their membership in the Society. The employment of foresters by private concerns can not be credited to the efforts of the Society. Owing to the limited circulation of the JOURNAL it has not been a force in public education, nor has it attempted to bring before prospective employers just what the forester can do. Now the question is: should these things be attempted by the Society?

Personally I am not in favor of the Society invading the field of general propaganda now held by the forestry associations. That certainly would not be the work of a manager, but surely the Society should and can be of greater help to its individual members. The profession of forestry should no longer be a voice crying in the wilderness, it

should be recognized as an economic necessity in our civilization. Forestry should no longer be a cause, it should be a business. The forester has something to sell, he is no longer a missionary. Yet, every year men graduate from our forestry schools who after spending two or more years each and several thousand dollars preparing to do something in the profession, are unable to secure positions as foresters. It is not as if there was no work to be done. There is room for hundreds of such men if only the prospective employers knew that the forester would be of value to them. Think of the large number of woodland owners for whom the forester could make or save money, but who do not know it. The field of private employment for the forester has never been exploited. In my judgment a manager of the Society could justify his salary working in that field alone.

He could:

a. Determine what foresters are now doing in private employment and whether their services are appreciated;
b. Place this information before all prospective employers in the same fields and help the men placed in positions to make good;
c. Help the misfits into congenial employment;
d. Keep before the public, through the use of special articles and other methods, what the forester can do and how his knowledge can help the many branches of industry related to the forest.
e. Seek new fields of employment for the forester which he is unable to discover himself; there are new fields not yet opened which the forester could occupy by merely taking a special course or two or by majoring in that special subject.
f. Cooperate with the secretaries of other professional societies, which would strengthen the general standing of the Society.

The profession lacks unity. We are not united in professional pride. A wholesome self-respect demands that the members of a profession be proud of it, but this attitude is difficult even to assume if one is unable to meet the demands of a decent American standard of living. It is well enough to talk about public service, but a man must first provide for himself and family before he can afford to be philanthropic with his time. A better understanding by the public of what the forester can do will remedy this situation and the activities of an efficient executive will go a long way toward that end.

It is pretty generally agreed that a paid executive would be a good proposition for the Society but the big difficulty is to find funds to pay him for the first few years, and here are some suggestions on that subject:—

a. The advertising in the JOURNAL could be greatly increased by systematic effort.

b. There are scores of "members" who by training and experience should be raised to "senior membership."

c. The question of raising the dues has not been put to the members in quite the right light. All calculations I have seen have been on the basis of immediate results. This is too much to expect. It will take any man a year to find himself on that job. Why not consider the proposition on a five-year basis? Suppose the dues were $8 for members, what would $40 spread over a five-year period be to the average man in the profession, if he could be assured that the profession would in that time be on a better basis. Certainly it has paid other societies to have an executive, or they would not have continued the practice.

d. Appoint a committee of 100, each of whom will agree to raise in some way one per cent of the difference between what the Society can now contribute toward the salary of the executive and the amount actually required to meet the cost, and that he will do so for a period of three years. The amount to be raised by each member of the committee would certainly not exceed $50 for the first year, and probably much less for the remaining two years. Surely 100 members can be found who will serve on such a committee. This plan would give the executive a fair chance and at the same time test the value of the idea. There are various ways by which the members of that committee could raise these funds; by getting new members, by securing advertising for the JOURNAL; by obtaining private contributions or by digging into their pockets for it. I am willing to be one member of such a committee.

If all the members of the Society could know the vast amount of work that the officers are called upon to do and could realize the personal sacrifice that you, Zon Dana and other officers have made for the Society, and could see Bob Stuart's desk as I did the other day, they would be chagrinned as I was to realize that they had not been willing sooner to share these burdens by a slight increase in dues.

Yours sincerely,

HARRIS A. REYNOLDS,
Secretary.

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H. F. Round, Secretary-Treasurer, Forester's Office, Pennsylvania R. R. Co., Philadelphia, Pa.

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C. L. Hill, Chairman, 1408 Grand Ave., Piedmont, Cal.
F. S. Baker, Secretary, 305 Hilgard Hall, Berkeley, Cal.

Central Rocky Mountain

E. W. Tinker, Chairman, Forest Service, Denver, Colo.
J. W. Spencer, Vice-Chairman, Forest Service, Denver, Colo.
H. D. Cochran, Secretary, Forest Service, Denver, Colo.

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D. S. Olson, Secretary-Treasurer, Forest Service, Missoula, Mont.

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A. H. Hodgson, Secretary-Treasurer, U. S. Forest Service, Portland, Ore.

Ohio Valley

Charles C. Deam, Chairman, Department of Conservation, Indianapolis, Ind.
Burr N. Prentice, Secretary, Purdue University, West Lafayette, Ind.

Southern Appalachian

E. F. McCarthy, Chairman, Room 610, New Medical Bldg., Asheville, N. C.
R. S. Maddox, Vice-Chairman, State Forester, Nashville, Tenn.
F. W. Haasis, Secretary, Appalachian Forest Experiment Station, Asheville, N. C.

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Roy G. Pierce, Member Executive Committee, Bureau of Plant Industry, Office of Blister Rust Control, Washington, D. C.

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F. G. Wilson, Secretary, Agricultural-Engineering Bldg., University of Wisconsin, Madison, Wis.

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